POSTER SESSION
BIOLOGICAL; MEDICAL
9:00 – 10:00AM
KERNS CHAPEL

Board 1 HIGH DIETARY PROTEIN INTAKE INCREASES SERUM ENZYME ACTIVITY FOLLOWING DAMAGING EXERCISE IN HUMANS. Amy L. Miracle, amiracle@kent.edu, Priti Rane, prane@kent.edu (Lonnie M. Lowery, llowery@kent.edu) Dept of Nutrition, Rm. 100 Nixson Hall, Kent State University, Kent OH 44242.
Rodent data suggest that high protein intakes can significantly elevate serum creatine kinase (CK) and aspartate transaminase (AST) concentrations following damaging exercise. The purpose of the present study was to determine the effects of protein intake on exercise-induced muscle injury (serum enzyme activity) in humans. The hypothesis was that large protein intakes (>1.8g/kg) increased serum enzymes 24 hours after eccentric exercise compared to moderate or low protein intakes. Twenty-six male volunteers completed either a 40-minute downhill run (n=14) or a 12-set resistance exercise protocol (n=12). The exercise protocols were similar in their induction of tissue damage (enzyme release). Based upon 5-day diet logs, participants were stratified by usual protein intake: "low", <1.4g/kg body mass; "med", 1.4-1.8g/kg; and "high", >1.8g/kg. Protein intakes differed significantly among categories but carbohydrate, fat and energy intake did not ($p>0.10$). Serum values of CK, AST, alanine transaminase (ALT), and lactate dehydrogenase (LDH) were measured prior to and 24 hours after exercise. Significant differences were found between the high (37.0±8.8) verses med (23.8±7.8) ($p=0.0027$) and low (22.6±7.3) ($p=0.0034$) protein intake groups for ALT. Significance was also found in AST values, with high protein intakes (32.6±7.5) resulting in larger concentrations compared to med (24.3±6.5) ($p=0.064$) and low (25.6±7.5) ($p=0.058$) protein intakes. Creatine kinase, similarly, was significantly different between the high (754.4±651.0) and med (287.3±120.0) protein intake groups ($p=0.032$). We conclude that humans respond similarly to rats, in that a high level of protein intake increases enzyme efflux following damaging exercise.

Board 2 EFFECTS OF PHENYLPROPANOLAMINE (PPA) ON BEHAVIOR, PROTEIN LEVELS, AND REPRODUCTIVE HORMONES IN YOUNG FEMALE RATS. Andrea M. Dvorak Andi51080@yahoo.com (Beth B. Pritts prittsbb@mail.lemoyne.edu) Dept of Biology, LeMoyne College, 1419 Salt Springs Rd, Syracuse NY 13214.
Phenylpropanolamine (PPA) is a chemical compound found in a number of weight loss products and over the counter cold medicines. This experiment is designed to test the effects of PPA (in the form of Dexatrim®, an over the counter diet drug) on young female CD IGS rats. The purpose of this project is to determine if PPA has behavioral effects, as well as having effects similar to those associated with starvation, such as protein degradation leading to muscle wasting. This experiment will use sixteen female rats, divided into a control and experimental groups, both of which will be fed ground rat chow, with the experimental rats receiving Dexitrim® mixed into their chow for a total of 30 days. After 20 days of PPA exposure, the rats will swim in a Morris water maze (MWM) once a day for a total of ten trials. There have been reports that those on weight loss products feel more nervous and agitated; therefore, PPA exposure could cause a decreased time to locate the podium. In addition, protein levels in the heart, kidney, liver, and muscle will be determined by a Lowry assay. Because weight loss and a decrease in food intake have been reported to alter menstruation, potential effects of PPA on female reproductive hormone levels will be determined using radioimmunoassay. Reproductive cyclicity will be assessed via vaginal lavage.

Board 3 IMMUNOLOGICAL RESPONSES ARE RELATED TO BIOCHEMICAL STRESS MARKERS IN THE ACUTE PHASE FOLLOWING DAMAGING EXERCISE. Priti Rane, prane@kent.edu; Amy Miracle, amiracle@kent.edu; Lonnie Lowery, llowery@kent.edu 100 Nixson Hall, Kent State University, Kent OH 44242.
Tissue damage and infection initiate a stereotypical sequence of host defense reactions called the acute phase response. The hypothesis of this investigation was that immunological factors like WCC (white cell count), neutrophils (Neut), and interleukin-6 (IL-6) following damaging eccentric exercise are related to biochemical stress markers including total urinary nitrogen (TUN), creatine kinase (CK) and lactate dehydrogenase (LDH) - often described in clinical situations. After obtaining pre-exercise urine and blood measurements, 14 male resistance-trained athletes performed six sets of six repetitions, each at 80% of their one repetition maximum strength (1RM). Blood samples were taken at 2 hr post–exercise and every 24 hr thereafter for five days. They were examined for differential WCC, IL-6, CK and LDH while 24-hour urine samples were assessed for TUN. Analysis of data showed no significant relationships between immune variables and stress markers. Relationships however emerged post-exercise. TUN and Neut were correlated ($r=0.67$, $p=0.009$; $r=0.75$, $p=0.002$; N=14 at 24 and 48 hr respectively. LDH and IL-6 ($r=0.83$, $p=0.003$ and $r=0.83$, $p=0.003$ at 2 hr and 24 hr respectively; N=10), CK and IL-6 ($r=0.85$, $p=0.03$ and $r=0.64$, $p=0.05$ at 2 and 24 hr, respectively), and LDH and WCC were correlated ($r=0.67$, $p=0.010$ at 24; N=7). All relationships disappeared by 72 hr. Based upon these findings; we conclude common stress markers following eccentric exercise are related to immune function. Future investigations are needed to determine whether immune stimulation is mechanism behind exercise-induced catabolism

Board 4 A MRI COMPARISON OF THE CAUDATE NUCLEI VOLUMES IN DEPRESSED WOMEN AND NORMAL CONTROLS. Tiffany Frankhauser s03.tfrankhauser@wittenberg.edu (Cathy L. Pederson, cpederson@wittenberg.edu) Wittenberg University, Dept of Biology, PO Box 720, Springfield OH 45501.
Recent evidence suggests that the caudate nucleus may play a role in depression as the destruction of the caudate nucleus leads to changes in behavior and problem solving. Therefore, it is expected that a significant reduction will be observed in the volume of the caudate nuclei in depressed subjects when compared with nondepressed controls. Fifteen right-handed women ages 20 to 40 were categorized into two groups: six subjects suffering from major depression as indicated by elevations above 85 on the *Millon Clinical Multiaxial Inventory*, and nine nondepressed controls. There was no signigicant difference between the groups based on age, education, IQ, alcohol intake, or smoking habits ($p>0.442$, n=15). Using 3D Brainstation on magnetic resonance images, three tracings were taken of the left and right caudate nuclei with a mouse-driven cursor every 2mm in transaxial slices. These values were averaged and the results summed to approximate the total volume of the caudate nuclei. The goal was to determine whether there was a significant difference in the volume of the caudate nuclei in women who were depressed compared to nondepressed controls. Preliminary results of the omnibus test from MANOVA show no significant difference in the left or right caudate nucleus between groups [$F(2.12)=1.08$, $p=0.372$, $Eta^2=0.152$].

Board 5 THE EFFECT OF OVER-THE-COUNTER DEHYDROEPIANDROSTERONE (DHEA) ON SERUM SODIUM CONCENTRATION IN MICE. Carrie Mills, cmills@wilmington.edu Arin Fletcher, Emily Richards, (Donald Troike, don_troike@wilmington.edu) Dept of Biology, Wilmington College, 251 Ludovic St, Wilmington OH 45177.
DHEA, a hormone secreted by the adrenal gland, is believed to enhance a wide range of physiological functions. It first appears in humans in about their seventh year of life and peaks around the age of 25 before gradually declining to very low levels by age 70. This has produced a market for the over-the-counter (OTC) sales of this hormone. A previous study demonstrated that purified DHEA (Sigma Chemical) significantly elevated serum sodium concentrations in male mice. Since OTC-DHEA preparations are derived from plant sources, it was of interest to test the effectiveness of an OTC formulation. In this study 3 groups of 6 male mice were used. Each was administered 0.5 ml of one of three solutions by gavage: vegetable oil alone, vegetable oil containing 1 mg of purified DHEA (Sigma), or vegetable oil containing 1 mg of OTC-DHEA (General Nutrition Corp). Eight hours later tail vein blood was collected from each mouse and the sera separated by centrifugation. Blood samples were also collected prior to gavage. All serum samples were diluted 1/2500 with deionized water and their Na concentrations determined with a Perkins Elmer Atomic Absorption Spectrometer following directions in its procedure manual. Preliminary results at this time indicate that the OTC-DHEA does not elevate serum Na concentrations, unlike the purified product. If this holds true in subsequent experiments, then we question the labeling and effectiveness of OTC-DHEA products.

Board 6 HIPPOCAMPAL VOLUMES AND MEMORY CAPABILITIES IN WOMEN WITH POSTTRAUMATIC STRESS DISORDER SECONDARY TO CHILDHOOD ABUSE. Megan A. Hoffmann, s02.mhoffmann@wittenberg.edu Christina M. Peters, Kelly A. Zander. (Cathy Pederson, cpederson@wittenberg.edu) Wittenberg University, Dept of Biology, PO Box 720, Springfield OH 45501.
Abuse during childhood has been shown to induce Posttraumatic Stress Disorder (PTSD) in some trauma survivors. In this study, right handed women ages 20 to 40 were categorized into three groups: PTSD and abuse group, abuse only group, and normal controls (n=33, 11 per group). Dividing the subjects in this way allowed for differentiation between abuse and PTSD effects. Placing subjects into triads, one from each group, compensated for possible variation in age, education, IQ, body mass index, alcohol intake, and nicotine habits ($p>.07$). After an initial phone questionnaire, subjects answered demographic questions and took the *Childhood Trauma Questionnaire*, the *Trauma Symptoms Inventory*, and the *Million Multiaxial Clinical Inventory*. Subjects were given the *Weschler Memory Scales* (WMS), were interviewed to determined PTSD status, and had an MRI brain scan taken. Because the hippocampus is the center of learning and memory in the brain, itemized WMS scores were statistically compared using one-way ANOVA testing to assess differences among the three groups. There was no significant difference in the initial omnibus test between groups, covarying for IQ, for WMS age-adjusted subscores of auditory immediate memory, auditory delayed memory, visual immediate memory, visual delayed memory, nor working memory ($p=0.445$, $F(10,50)=1.01$, $Eta^2=0.069$). Bilateral hippocampi were traced by a researcher blind to group status. Hippocampal tracings in sagittal slices in which the hippocampi appears is currently in progress.

Board 7 IS GLUCOCORTICOID EXCITOTOXICITY RESPONSIBLE FOR THE DETERIORATION OF THE HIPPOCAMPUS IN POST TRAUMATIC STRESS DISORDER? Christina M. Peters s02.cpeters@wittenberg.edu Kelly A. Zander, (Cathy L. Pederson, cpederson@wittenberg.edu) Wittenberg University, Dept of Biology, PO Box 720, Springfield OH 45501.

Posttraumatic stress disorder (PTSD) is a mental affliction resulting from exposure to a trauma, such as childhood abuse. The hippocampus contains a high density of glucocorticoid receptors, and it is thought that increased levels of glucocorticoids in PTSD cause excitotoxicity of the hippocampus. If that is the case, other areas of the brain with a high density of glucocorticoid receptors, such as the hypothalamus, should also atrophy in women with PTSD. Twenty-seven right-handed women aged 20-40 who had a history of childhood abuse were divided into three groups: PTSD, abuse only, and normal controls. Each woman received a magnetic resonance image of her brain. A researcher blind to group assignment traced both the right and left hippocampus and hypothalamus. No statistically significant difference was found among the three groups in age, years of education, IQ, body mass index, drinks per year, or pack years of cigarette smoking ($p>0.15$). A MANOVA omnibus test revealed a significant difference in left and right hippocampal volume ($p=0.02$, $F(2,24)=4.69$, $Eta^2=0.28$). While no statistically significant difference was found in the volume of the right hippocampi ($p=0.78$) between PTSD and normal controls, the left hippocampi were significantly smaller in women with PTSD when compared to normal controls ($p=0.02$). In contrast, an omnibus test revealed no significant difference between left and right hypothalamic volumes ($p=0.64$, $F(2,24)=0.46$, $Eta^2=0.12$) for the three groups. These results indicate that another mechanism may be acting in synergy with glucocorticoid excitotoxicity to cause hippocampal, but not hypothalamic, atrophy.

Board 8 THE TOXICITY OF ALCOHOL ON THE CEREBELLAR VERMIS. Emily L. Kingsley, s04.ekingsley@wittenberg.edu Megan A. Mehicic, Sarah M. Charles, (Cathy L. Pederson, cpederson@wittenberg.edu) Wittenberg University, Dept of Biology, PO Box 720, Springfield OH 45501-0720.

In examining the adverse effects of ethanol on the neurological function of the brain, our study sought to ascertain the extent of cerebellar vermis deterioration in women who are moderate alcohol drinkers. Damage to this region leads to loss of Purkinje cells which are critical for relaying neuronal messages concerning movement stability. The subjects were eleven right-handed women between the ages of 20 and 36 years who exhibited no significant difference in age, years of education, body mass index, alcohol dependency, pack years of cigarette smoking, drug use, anxiety, depression, and histrionics ($p \geq 0.06$). The size of the vermis for each subject was determined by averaging the tracing of approximately 25 horizontal slices viewed on magnetic-resonance imaging (MRI) using *3D Brainstation*™. For each slice in which the vermis was fragmented, the average number of fragments per slice was calculated. The control group included six subjects with an alcohol intake of five drinks or fewer per year (mean=0.54 drinks/year). The experimental group consisted of five women who drank between 120 and 312 drinks per year (mean=200.8 drinks/year). The results of the study indicated no significant difference ($p=0.59$) in the volume of the cerebellar vermis between the two groups. There was also no statistical variance in the fragmentation of the vermis between the groups ($p=0.226$). This study demonstrates that minimal damage is seen in moderate alcohol drinkers when compared with non-drinkers.

Board 9 ALLERGENS IN HOUSE DUST MITE EGGS. Ndate Fall, fall.2@wright.edu Larry G. Arlian, larry.arlian@wright.edu Marjorie S. Morgan, marjorie.morgan@wright.edu and R. Jeff. Schumann, schumann.3@wright.edu Wright State University, Dept of Biological Sciences, Dayton OH 45435.

House dust mites are small arachnids that are prevalent in carpets, sofas, mattresses and bedding in homes in humid climates worldwide. They are the source of multiple potent allergens that trigger allergic reactions in humans and dogs predisposed to allergies. At least 14 groups of allergens have been isolated and characterized; however, there are still others that remain to be characterized. Some of these characterized allergens are associated with digestive enzymes and other internal body proteins, such as tropomyosin. It has been assumed that most of these allergenic proteins are associated with the active life stages of the mites. The purpose of our study was to determine if dust mite eggs are also a source of allergenic proteins. Fresh eggs (more than 1000 and less than 24 hrs old) were collected from confined females, then aqueous extracts were prepared from the eggs. Presence of allergenic products in these extracts was then determined by Western blotting. Blotting was done using serum from dust mite sensitive patients. SDS-PAGE showed that eggs contained multiple soluble proteins with molecular weights between 10 to 230 kDa Antisera from rabbits immunized with whole body mite extract contained antibody directed at some of these egg proteins. When these SDS-PAGE resolve egg proteins were incubated with sera from dust mite sensitive-patients and subjected to autoradiography, several IgE binding proteins were evident. Therefore, house dust mite eggs are a source of allergenic proteins.

Board 10 ASSESSING DIABETES RESISTANCE OF NOD.Ea^d TRANSGENIC MICE BY ADOPTIVE TRANSFER OF DIABETOGENIC T-CELL CLONES. Samantha A. Smith, s02.smith@wittenberg.edu (Matthew S. Hanson, mhanson@wittenberg.edu) Wittenberg University, Ward Street at N. Wittenberg Ave., PO Box 720, Springfield OH 45501-0720.

The non-obese diabetic (NOD) mouse strain serves as an animal model for human Type I diabetes. The most important genetic factors contributing to diabetes susceptibility in humans and NOD mice are the class I and II genes of the major histocompatibility complex (MHC). MHC class I (k and d) and II (I-A and I-E) molecules facilitate the maturation of T lymphocytes that will react against pathogens while also being tolerant of self-molecules. NOD mice express a unique I-A^{g7} molecule, but do not express I-E molecules. Diabetes in NOD mice can be prevented by transgenic introduction of I-E alpha genes (NOD-Ea^d), which restores I-E expression. The exact mechanisms by which I-E expression prevents diabetes in NOD mice are unknown. The purpose of our experiments is to determine if diabetes-resistant NOD.Ea^d mice are capable of suppressing a highly diabetogenic T cell clone. Five to ten day old NOD.Ea^d mice were injected with saline (n=3) or $5\text{-}10 * 10^6$ diabetogenic T cells (n=9) and followed for diabetes development. Diabetes was diagnosed by assaying for the presence of glucose in the urine. Histological examination of pancreata from recipient mice was used to confirm the destruction of insulin-producing islet beta cells. By 60 days post transfer, 5 of 9 recipients of the T cell clone became overtly diabetic and none of the control saline recipients became diabetic. These results demonstrate that the I-E mediated protective mechanisms, which prevent diabetes in the NOD.Ea^d mice, are unable to inhibit the diabetogenicity of a T cell clone when injected during the neonatal period.

Board 11 ACCURACY OF COMBINED DIFFUSE REFLECTANCE AND INTRINSIC FLUORESCENCE IN IDENTIFYING CORONARY ATHEROSCLEROSIS. George O. Angheloiu[1], anghelg@ccf.org Joseph T. Arendt[1], Sweder W. E. van de Poll[2], Markus G. Mueller[3], Abigail Haka[3], Irene Georgakoudi[3], Barry Kuban[1], Jonathan Myles[1], Maryann Fitzmaurice[4], Michael S. Feld[3], John R. Kramer[1], [1]The Cleveland Clinic Foundation - ND 20, 9500 Euclid Ave., Cleveland OH 44195, [2]Leiden University Medical Center, Postbus 9600, 2300 RC Leiden, The Netherlands, [3]Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge MA 02139, [4]Case Western Reserve University, 2085 Adelbert Rd., Cleveland OH 44106.

An intrinsic fluorescence (IF) and diffuse reflectance (DR) based algorithm was designed for coronary atherosclerosis diagnosis of in-vitro tissue. In contrast to fluorescence, IF spectra are free from distortions introduced by tissue scattering and absorption. White light DR and fluorescence emission spectra generated at 11 laser excitation wavelengths (λ_x) were collected from heart transplant and autopsy cases with an original instrument called FastEEM. IF spectra were extracted by combining DR and fluorescence spectra using a photon migration model. IF spectra were fit to a linear combination of collagen and elastin spectra at λ_x=342 nm, and of collagen and component C at λ_x=480 nm. C spectrum was derived from multivariate curve resolution analysis of IF and related to that of ceroid, a lipid oxidation product in atherosclerotic lesions. We calculated the contributions of collagen and elastin to IF at λ_x=342 and of C at λ_x=480 nm, and also the contribution of beta-carotene absorption to DR. A coronary atherosclerosis diagnostic algorithm was derived. Specificity, sensitivity and validity were verified by leave-one out cross-validation. Coronary segments (n=110) were studied: 22 normal and intimal fibroplasia and 88 non-calcified and calcified atherosclerotic/atheromatous plaques. An algorithm using percentage of collagen contribution to IF at λ_x=342 nm, contribution of C to IF at λ_x=480 nm and that of beta-carotene to DR had sensitivity 95%, specificity 91% and PPV 98%. We demonstrated that fundamental parameters extracted from spectral data can accurately diagnose atherosclerotic lesions using features similar to those used by pathologists.

Board 12 CARDIAC FUNCTION AS MEASURED BY CREATININE CLEARANCES FOLLOWING PERATIVE CORRECTION OF CONGENITAL HEART DEFECTS. Suzanne M. Eggleston, suzanneeggleston@yahoo.com Dr. Nancy Woodley, Ohio Northern University, 214 South Johnson Street, Ada OH 45810 and Dr. A. Marc Harrison, Cleveland Clinic Foundation.

Creatinine is a waste product produced by the body that is normally filtered and completely cleared from the blood by the kidneys. Since creatinine is not reabsorbed or secreted by the kidney, it gives a good indication of the glomerular filtration rate (GFR), which is the rate at which the kidneys filter out waste products. Furthermore, GFR is directly related to heart function because, in order for the kidneys to function properly, they must receive blood from the heart. Creatinine clearance (CrCl) may be used to indicate cardiac function following post-operative correction of congenital heart defects; heart malformations that are present at birth. In this study, post-operative CrCl and thereby cardiac function of neonates with hypoplastic left heart syndrome (HLHS) (n=4) and transposition of the great arteries (TGA) (n=5) was compared to determine if restorative function of the two defects were equivalent. ANOVA conducted at a 95% confidence level were used on data prospectively collected as part of an unrelated study. There was no significant difference between the CrCl of patients with HLHS versus those with TGA. However, the CrCl of HLHS and TGA patients was significantly reduced when compared to the normative value of 39 mL/min/(m^2). This was expected due to the insufficiency of blood flow caused by HLHS and TGA.

Board 13 EFFECTS OF ANTISENSE KNOCKDOWN OF MONOAMINE OXIDASE-B ON ACUTE DOPAMINE RELEASE INDUCED BY 3,4-METHYLENEDIOXYMETHAMPHETAMINE. Valerie J. Cook, v-cook@onu.edu Nancy Woodley, and Jon E. Sprague, Ohio Northern University, Ada OH 45810.
In the present study, we examined the effects of an antisense (AS) oligonucleotide (ODN) targeted at monoamine oxidase-B (MAO-B) on the acute release of dopamine following treatment with 3,4-methylenedioxymethamphetamine (MDMA, ecstasy). This was done in order to determine if AS knockdown of MAO-B has an effect on acute dopamine release and/or turnover as assessed by changes in 3,4-dihydroxyphenylacetic acid (DOPAC) levels following treatment with MDMA. Seven Sprague-Dawley rats were surgically implanted with microdialysis cannulae into the caudate putamen; three of these animals were also surgically implanted with an osmotic minipump. The minipump administered the AS ODN to MAO-B at constant rate of 0.5 µL/hr for seven days, yielding a total daily dosage of 600 pmols/day. At the end of the seven-day treatment all of the rats were treated with MDMA (10 mg/kg, sc) and the cerebral dialysate was collected using microdialysis. Samples were collected at 20-minute intervals for a total collection period of 180 minutes. These samples were then analyzed via High Pressure Liquid Chromatography with electrochemical detection. The amounts of dopamine and DOPAC were recorded as a percent of baseline levels. The results showed no change in the levels of acute dopamine in the rats treated with AS ODN to MAO-B as compared with those treated only with the MDMA corresponding with the hypothesis that it does not alter acute dopamine release. A significant ($p<0.05$) decrease in DOPAC levels was seen in the AS/MDMA treatment group indicating that the AS had, in fact, resulted in a knockdown of MAO-B.

Board 14 SCANNING ELECTRON MICROSCOPE STUDY OF HYDROGEL CONTACT LENSES FOLLOWING TREATMENT WITH COMMERCIALLY-AVAILABLE CLEANING/DISINFECTING SOLUTIONS. Sarah C. Miller, scmiller@owu.edu (Laura Turner-Cushing, lcturner@owu.edu) Ohio Wesleyan University, HWCC Box 336, Delaware OH 43015.
This project seeks to use scanning electron microscopy (SEM) to determine whether damage occurs to Bausch and Lomb PureVision™ contact lenses while using commercially available cleaning/disinfecting solutions. PureVision™ contact lenses are made from balafilcon A, a silicon hydrogel material containing 36% water. The silicon is made hydrophilic by the Performa™ process that provides a build-up resistant surface. PureVision™ contact lenses are designed for 30-day extended wear and are currently prescribed for 1 to 7 day continuous wear. Six different types of solutions were used including MiraFlow® (CIBA Vision®), AOSept® (CIBA Vision®), UltraCare® (Allergan), Opti-Free® (Alcon), Opti-Free Express® No Rub, and ReNu MultiPlus® Multi-Purpose Solution (Bausch & Lomb). Sterile saline was used to rinse the lenses. In a blind study, seven contact lenses were cleaned as directed with each solution. The surface details were observed using SEM with cryogenic preparation. Images were taken at seven-day intervals over a 7-week period. Preliminary results show that the SEM images of those contact lenses viewed at the beginning of the study have little buildup and damage while those viewed after several weeks of the study have more build-up and some pitting associated with both anterior surface and internal composition. With the exception of one solution used, all other solutions showed similar results on the contact lenses. This exception showed considerable build-up, which may have covered the possible damage to the contact lens.

Board 15 STUDIES ON WHITE LEAF SPOT OF WALNUT INCITED BY *Microstroma juglandis*. David L. Mason, dmason@wittenberg.edu Dept of Biology, Wittenberg University, Springfield OH 45501.
The objective of this study was to investigate the host parasite relations of the white leaf spot disease of *Juglans nigra* incited by the fungus, *Microstroma juglandis*. Infections revealed white, powdery, spore-bearing lesions 0.2-1 cm on the lower side of the leaves. The corresponding upper side of the leaf showed the lesions to be slightly bulbous and chlorotic. Histology by means of light and transmission electron (TEM) microscopy clearly revealed the fungal hyphae located between the mesophyll cells which are seen to be hyperplastic and to contain a reduced number of non starch-containing chloroplasts as compared to cells of a non infected leaf. No septal pores or Woronin bodies were detected between the fungal cells, and no direct or haustorial invasion of the host cells by the fungus were ever observed. Somewhat parallel mycelial accumulations beneath stomata were seen extending to form clusters of "basidium-like", spore-bearing, conidiophores that protrude through the opening of stomata. These reproductive structures were viewed approximately five times by means of light, TEM, and scanning electron microscopy (SEM). Spores of the fungus were cultured on various media, including: potato dextrose (PDA), corn meal (CM), and honey peptone (HP). On the three types of media, the spores produced yeast-like blastospores that continued to germinate, forming whitish, yeast-like colonies. No mycelial growth was observed. Fragments of sterilized leaves and ultarfiltrates of homogenized leaf materials added to the various media in conjunction with various temperature variations did not induce the spores to form mycelium. A number of attempts were made to infect leaves from spores produced on the host and from those grown in culture, but no infections occurred.

Board 16 STUDIES ON THE LEAF SPOT OF IRIS INCITED BY *Heterosporium iridis*. David L. Mason, dmason@wittenberg.edu Dept of Biology, Wittenberg University, Springfield OH 45501.
The objective of this study was to investigate the host parasite relations of the leaf spot of *Iris* incited by the Deuteromycete, *Heterosporium iridis*. Leaf infections revealed elongated, reddish-brown, necrotic, lesions surrounded by a yellowish, chlorotic ring of tissue. By means of stereoscopic microscopy, dark, spore-bearing conidiophores were seen extending out of stomata in the necrotic regions. Scanning electron microscopy (SEM) revealed early spore formation and mature 3-5 celled spores covered with spinules on the branching conidiophores. Spores both from nature and from culture transferred to uninfected leaves were seen by SEM to form hyphae that directly penetrate stomata. Some hyphae were also seen forming what appear to be an appressorium. Histology by means of light microscopy revealed that the epidermal and mesophyll cells in the presence of invading fungal hyphae undergo a rapid necrosis. Within this region of dead cells and at their margins only a few segments of hyphae could be detected. Spores of the pathogen were removed from infected leaves and grown in culture on corn meal (CM), potato-dextrose (PDA) and honey peptone (HP) media. Early spore germination, followed in culture by light microscopy, revealed that each cell of the four to five-cell spores produced branching septate mycelium. Within four days following germination, dark, branching, conidiophores bearing elongated, dark, four to five-cells spores could be seen. SEM on cultures clearly revealed the structure of the conidiophores and spinule-covered spores.

Board 17 CREATION AND CHARACTERIZATION OF A SILENT EcoRV RESTRICTION SITE IN THE GENE SEQEUNCE OF THE LACTOSE PERMEASE OF *ESCHERICHIA COLI* BY SITE DIRECTED MUTAGENESIS. Emily R. Stout (Amy E. Jessen-Marshall, AJessen-Marshall@otterbein.edu), Dept of Life and Earth Sciences, Otterbein College, Westerville OH 43081-1468.
The ability to manipulate gene sequences by site-directed mutagenesis is a powerful technique derived from molecular biology. It is possible to create specific amino acid mutations at the DNA level, then characterize these effects at the level of the protein. The use of PCR (polymerase chain reaction) to create these mutations requires the presence of novel restriction enzyme sites to allow for the cloning of these mutant fragments into the wild type gene sequence. The objective of this project is to create a novel EcoRV restriction site in the gene sequence of the lactose permease of *Escherichia coli*. There are only eleven novel restriction sites currently identified in this gene sequence, with no novel sites in the location of transmembrane domain two, making additional study in this region of the protein difficult. The addition of this new site will allow site directed mutagenesis to be further pursued in the first two transmembrane domains of this protein, opening new questions about the structure and function of this protein. This mutation was created by using downstream flanking restriction sites that incorporate a mutant primer for the novel EcoRV site at the desired location. This PCR fragment was subcloned into a commercially available PCR cloning vector. In a series of several trials at each step, the fragment was restriction digested, isolated and purified using Gene Clean™, and then ligated into the plasmid pACYC184. The completion of this project will involve the final cloning of the mutant fragment into the wild type gene in plasmid pQE30-LacY C148S. The success of this cloning will be verified by restriction enzyme analysis of the new fragment.

Board 18 PURIFICATION AND CHARACTERIZATION OF *STAPHYLOCOCCUS AUREUS* SEROTYPE 8 CAPSULAR POLYSACCHARIDE. Elena Bocola-Mavar[1], ebozzola@msn.com Diana L. Fagan[1], dlfagan@cc.ysu.edu Jeffrey A. Smiley[2], jasmiley@cc.ysu.edu [1]Youngstown State University, Dept of Biological Sciences and [2]Dept of Chemistry, Youngstown OH 44555.
Infections caused by *Staphylococcus aureus* remain the number one cause of hospital-acquired infections. It has been shown that the immune response in the host includes forming antibodies against the bacterial capsular polysaccharide (CP). Bacteria containing type 8 CP have been isolated from 44% of the patients with nosocomial infections. The goal of this study is to obtain a pure cell wall carbohydrate of *S. aureus* expressing type 8 CP. Sodium chloride (2%) supplemented Columbia Broth was used to grow 8 liters of bacteria. After lysing the cells with lysostaphin, and removing nucleic acids with DNAse and RNAse, the CP was separated from other cell components by DEAE Sephacel chromatography. The presence of CP was detected using a Red Tetrazolium test for reducing sugars, as well as the absorbance at 213 nm. Teichoic acid contamination was determined by the microdetermination of phosphorus. The ion-exchange column showed the presence of three peaks. Two tested positive for CP, one was eliminated because of teichoic acid contamination. CP was broken down into oligosaccharides with 70% HF. HF solvolysis will allow for spectrometric analysis as a method of identifying the carbohydrate. Purified carbohydrate will be used to develop monoclonal antibodies against type 8 CP.

Board 19 PREPARATION OF TAQ POLYMERASE AND ITS USAGE IN THE PCR DETECTION OF LYME CAUSING PARASITE, *Borrelia burgdorferi*, IN HARD TICK, *Ixodes ricinus*. Supriya.S.Pai, (Dr. Marten Edwards, mjedward@cc.owu.edu). Ohio Wesleyan University, Dept of Zoology, Delaware OH 43015.

Ixodes ricinus ticks are the primary vectors of Lyme Borreliosis in Central Europe, Czech Republic being one of the many affected nations. Clinical manifestations of Lyme Borreliosis include a characteristic rash (*erythemia migrans*) and flu symptoms. More severe infections may result in facial palsy, cranial nerve lesions, arthritis, mild encephalitis and heart conditions. *Borrelia burgdorferi*, the causative agent of Lyme Borreliosis, is a gram-negative spirochete that enters the human host during the blood feeding of ticks. The goal of this research project was to study the rate of *Borrelia burgdorferi* infection amongst the *Ixodes ricinus* ticks. *Borrelia burgdorferi* infection was detected in *Ixodes ricinus* females that were collected in the region of Ceske Budejovice, Czech Republic. Bacterial DNA isolated using the GFX column kit was amplified using the Polymerase Chain Reaction (PCR). DNA was isolated from wild *Ixodes ricinus* adults and used as a template in PCR reactions that used primers specific for the *Borrelia burgdorferi* DNA sequences. In order to perform the PCR reactions, recombinant Taq DNA Polymerase was purified from a bacterial expression vector. The activity of the recombinant polymerase was verified using purified samples of *Borrelia burgdorferi* DNA. This DNA was isolated and purified from cultured *Borrelia burgdorferi.* Serial dilutions of the DNA sample were used to determine optimum Taq Polymerase activity level. PCR amplified products were loaded onto agarose gels, and 307 bp bands were observed. These bands detected the *Borrelia burgdorferi* DNA and thus the presence of *Borrelia.* Out of the 700 ticks analyzed in 35 trials, 245 ticks were found to be infected with *Borrelia burgdorferi.*

Board 20 CONSTRUCTION AND TESTING OF A PARTICLE INFLOW GUN FOR THE TRANSFORMATION OF *PARAMECIUM.* Dean Fraga, dfraga@acs.wooster.edu Erica Keenan, and Whit Schofield, College of Wooster, Biology Dept, Wooster OH 44691.
We have successfully built a particle inflow gun (commonly called a PIG) and used it to transform *Paramecium* using tungsten and gold particles (1 um in diameter). PIGs represent an economical way to use bioballistics to transform a variety of organisms. We describe how to construct such a gun, its basic principles of operation and provide a summary of our success using both tungsten and gold particles to transform *Paramecium* with linear and circular pPXV-NEO, a plasmid that can confer paromomycin resistance to *Paramecium*. Our basic methodology is as previously described in which autogamous cells are collected by centrifugation and resuspended in a simple buffer. The cells are placed in a vacuum chamber beneath a swinge filter containing DNA that has been $CaCl_2$-spermidine precipitated onto tungsten or gold particles. A 50 msec blast of pressurized helium gas (80 psi) is used to fire the particles into the *Paramecium* cells contained in a chamber under vacuum. The cells are removed and after a period of recovery (2-3 days) in culture media, 50 ug/mL paromomycin is added and cells are scored for survival after two days. We found tungsten to be as effective as gold in achieving transformation (0.7± 0.9% vs. 1.6± 1.7%, respectively, N=3). Circular and linear DNA gave comparable transformation efficiencies (1.6± 1.7% vs 0.53± 0.98%, respectively, N=3). Additional experiments demonstrated that tungsten did not significantly nick the DNA under our conditions when compared to gold treated DNA.

Board 21 CLONING OF GM3 SYNTHASE GENE UNDER THE CONTROL OF DOXYCYCLINE RESPONSIVE PROMOTER. Marsha Y. Bratzel, bratzel.1@osu.edu Hany E. Saqr, and Allan J. Yates, yates.1@osu.edu Ohio State University, Division of Neuropathology, Room 4166 Graves Hall, 333 W. 10th Ave., Columbus OH 43210.
Gangliosides are a family of sialic acid containing glycolipids that are present in most mammalian cells and highly concentrated in neuronal membranes. Although the cellular functions of gangliosides are not fully understood, studies have shown that changes in ganglioside composition have been correlated with brain tumor grade. GM3 is the simplest ganglioside from which complicated gangliosides are synthesized. It contains two fatty acids, one sialic acid and a disaccharide, and is synthesized by GM3 synthase enzyme. To study the effect of controlled overexpression of GM3 in glioma cells, we cloned GM3 synthase in PREV-TRE vector. This vector has a promoter that is activated only in the presence of tetracycline or tetracycline analogues (e.g. Doxycycline). We digested PREV-TRE with SalI restriction enzyme, then ligated the GM3 synthase gene digested with XhoI to the vector. After ligation, we transformed the cDNA into competent XL10 *E. coli* cells and spread the cells onto an ampicillin resistant plate over night at 37Ú Celsius. We picked all the colonies and began a series of DNA minipreps. DNA from these minipreps were separated using electrophoresis on a 0.7% agarose gel. Potential clones were digested with SspI and XhoI to determine the direction of the inserted gene. Out of eleven clones retrieved, two clones (pMB101 and pMB102) contained the GM3 synthase gene in correct orientation. These clones will be used to transfect the GM3 synthase gene into cultured glioma cells. These tranfected cells are essential to study the effects of endogenously synthesized GM3 on glioma biology.

Board 22 ISOLATION AND CHARACTERIZATION OF FEATHER-DEGRADING AND CELLULOSE-HYDROLYSING *STREPTOMYCES.* Roshni K. Nuggehalli, rknuggeh@owu.edu Jann M. Ichida, jmichida@owu.edu Ohio Wesleyan University, Botany/Microbiology Dept, Delaware OH 43015.
Streptomyces, common soil bacteria that occur on the plumage of about 64% of wild birds, especially bark-probers, are known to degrade feathers. This experiment focused on isolation and characterization of *Streptomyces* spp. using both selective and differential agar and basal media to determine the most effective techniques. Of 13 strains tested, a thermotolerant *Streptomyces* spp. OWU 1455, isolated from a Downy Woodpecker (*Dryobates pubescens*), was found to degrade feathers *in vitro* from 28-40° C. This strain was most compatible with the keratinase-producing *Bacillus licheniformis* OWU 1004B when tested by the cross-streak method on Mueller-Hinton agar plates to check for inhibition of *B. licheniformis* due to antibiotic production by the 13 *Streptomyces* spp. OWU 1455 and OWU 1004B were used as a dual inoculation for composting feather waste in five 4-L bioreaction vessels, while five control bioreactors were left uninoculated. Many antibiotics are produced as secondary metabolites of *Streptomyces* species. Pathogenic bacteria isolated from chicken feather waste were inhibited by *Streptomyces* 1455 as shown by the cross-streak plating method. Of special interest was a multiply antibiotic-resistant strain of *Salmonella enterica* serovar Enteritidis because antibiotic resistant bacterial infections have been traced to the use of broad-spectrum antibiotics in livestock and poultry feed. Since many *Streptomyces* spp. are widely used in applied and industrial microbiology, carbon (e.g. several sugars and cellulose) utilization tests were done for additional characterization. Strain 1455 hydrolyzed cellulose especially well with the addition of cellobiose. Because poultry and livestock waste contains large amounts of straw, sawdust and wood chips, thermotolerant bacteria that produce keratinase and cellulase would be of great value in enhancing the composting process.

Board 23 ANALYSIS OF AMINO ACID LOCATIONS AT THE MEMBRANE BOUNDARY BY THE CREATION AND CHARACTERIZATION OF CYSTEINE MUTATIONS IN THE FIRST PERIPLASMIC LOOP OF THE LACTOSE PERMEASE IN *ESCHERICHIA COLI.* Mary W. Lawley (Amy E Jessen-Marshall. AJessen-Marshall@otterbein.edu) Dept of Life and Earth Sciences, Otterbein College, Westerville OH 43081-1468.
The lactose permease functions as a symport protein in the inner membrane of *Escherichia coli.* Working models of the protein transmembrane domains in the membrane are based on hydropathicity plots that identify hydrophobic and hydrophilic regions of the protein and by comparison to other known membrane proteins. We are interested in determining the location of the amino acid boundary in the membrane for one of the periplasmic loops by the use of a membrane impermeable sulfhydryl specific fluorescent probe, Oregon-Green Maleimide. The objective of this project is to create cysteine residue changes in the first periplasmic loop and test the membrane/protein boundary using the fluorescent probe. The three-cysteine mutations were created by PCR based site-directed mutagenesis. The mutant fragments were isolated by restriction enzyme digest, purified by using the Gene Clean™ protocol and ligated into an intermediate plasmid vector pACYC184. The fragments will then be cloned into the wild type gene sequence found in pQE30-LacYC148S. The sequence will be verified by automated sequencing. The protein will be expressed and purified using Qiagen™ nickel columns and tested by fluorescence analysis of SDS-PAGE gels. We expect to identify the amino acids located at the membrane boundary of periplasmic loop 1-2 based on the presence or absence of fluorescence in protein preparations.

Board 24 TOTAL BACTERIAL AND COLIFORM LEVELS AT THE OLENTANGY RIVER WETLANDS RESEARCH PARK. Terry D. Hinds. Jr., hindst@shawnee.edu Judith L. Gardner, Rachel Brown, Hui Suk Jones, and Eugene H. Burns, Jr., eburns@shawnee.edu Shawnee State University, Dept of Natural Sciences, 940 Second St., Portsmouth OH 45662.
The Olentangy River Wetlands Research Park, Columbus OH, contains one man-made wetland area (wetland 1) that was planted with native plants during construction in 1994 and one (wetland 2) that was not planted. Although much other research has been performed, the bacterial population has not been studied previously. The purpose of this study was to determine total bacterial number in both wetlands and to catalog the effect of water flow through the wetlands on coliform levels. One sample from the river, five samples from five sites within each wetland, and one sample from the swale were taken monthly from October 2000 to August 2001 (except months when the wetlands were frozen). Samples were used for standard plate counts on trypticase soy agar and coliform counts using phenol red lactose broth and eosin methylene blue agar. Samples were subjected to presumptive, confirmed, and completed tests in the multiple tube technique with most probable number analysis. Total bacterial numbers varied from month to month but showed a mean 73.63%± 29.4% decrease in colony forming units (cfu) from the inlet of wetland 1 to its outlet. Wetland 2 increased 50.85%± 114.4% in total bacterial numbers in cfu. These differences are not statistically significant (P=0.1336). Coliform concentrations (coliforms/100ml) decreased from 44.4% to 93.9% per month as water traveled from the inlet to the outlet. From seven observations, the mean decrease in coliform concentration (coliforms/100 ml) was 80.04%± 17.9% in wetland 1 and 72.12%± 17.0% in wetland 2. These differences are not statistically significant (P=0.2801). These data suggest that both wetland areas reduce levels of coliforms as water flows through them, although total bacterial numbers may not decrease.

Board 26 SURVEY OF THE COLEOPTERA AT THE RAVENNA TRAINING AND LOGISTICS SITE. Roger Williams, williams.14@osu.edu and Diane Hartzler,

Dept of Entomology, OARDC, Ohio State University, Wooster OH 44691.
We are participating in a long-term study of the biological biodiversity at the Ravenna Training and Logistics Site (RTLS). The 2000 growing season was the second year we conducted surveys of the beetles in the RTLS. We utilized experimental traps and attractants from several sources in addition to homemade terrestrial traps, aquatic nets, beating sheets, and hand collecting in various habitats. Counts were made of the numbers caught, and the location of each was recorded. Labels with all pertinent data were placed with specimens and determination to taxon on a separate label. Most determinations were to species by specialists of that group. Abundance ratings were used to give an estimate of population size of species. Several species of beetles were encountered in Ohio for the first time. The combined data from 1999 and 2000 collecting seasons resulted in 682 species, 75 families, and 13,638 specimens represented. In addition to new state records we also have new county records, plus a few rare and unusual specimens which should stimulate interest and prompt further study. This study was administered under the direction of the Division of Natural Areas and Preserves of the Ohio Dept of Natural Resources with the funding supplied by the Ohio Army National Guard.

Board 27 SYNTHETIC PREPARATION OF A POTENT TICK ATTRACTANT FOR TRAP BAITS. William J. Burke, s02.wburke@wittenberg.edu Amanda E. Johnson, Jay A. Yoder, jyoder@wittenberg.edu and Peter E. Hanson, phanson@wittenberg.edu Wittenberg University, Dept of Biology and Chemistry, PO Box 720, Springfield OH 45504-0720.
The attractant sex pheromone of ticks consists of a halogenated aromatic ring, 2,6-dichlorophenol. Females release 2,6-DCP during feeding and prompt vigorous attraction responses by males. Our study demonstrates, for the first time, attraction to a mixture of chlorophenols by the American dog tick, *Dermacentor variabilis* (Say), the principle vector of the agents of Rocky Mountain spotted fever and tularemia. The chlorophenol mixture was prepared by reacting phenol with sulfuryl chloride, SO_2Cl_2, in the presence of diisobutylamine. Gas chromatography/mass spectral analysis (GC/MS) indicated that the product mixture obtained by this method contained 2,6-DCP (89.4%), 2,4-dichlorophenol (7.6%), 2,4,6-trichlorophenol (2.4%), and 2-chlorophenol (0.6%) (N=4 trials). Interestingly, attraction to this chlorophenol mixture was stronger (*ca.* 20% more pronounced) when compared to the response to the naturally occurring sex pheromone 2,6-DCP (replicates of 15; N=3). This finding is significant in that *D. variabilis* is not known for its attraction behavior, and few attractants have been identified. We anticipate that this chlorophenol mixture may have practical application as a trap bait for use in tick monitoring and eradication programs.

Board 28 TIMING AND DETECTION OF SEX PHEROMONE PRODUCTION IN TICKS. Jessica L. Pizzuli, s02.jpizzuli@wittenberg.edu and Chris Sanders, s04.csanders@wittenberg.edu Jay A. Yoder, and Peter E. Hanson, Dept of Chemistry and Biology, Wittenberg University, 600 W. Ward St., Springfield OH 45501.
Secretion of the attractant sex pheromone by ticks serves to bring members of the mating pair together. The only verified attractant sex pheromone in the American dog tick *Dermacentor variablis* (Say), vector of Rocky Mountain spotted fever and tularemia in North America, is 2,6-dichlorophenol (2,6-DCP). Females release the pheromone while feeding, prompting nearby males to detach and search for the female emitter. In this study, we used a novel extraction technique (Soxhlet extractor) to isolate 2,6-DCP. Analysis by gas chromatography/mass spectroscopy (GC/MS) was used to compare extracts of nonfed and fed ticks. Eggs, nonfed and fed stages of larvae, nymphs, males, and females were tested (replicates of 100 each, N=3). 2,6-DCP was detected in fed females as expected. Interestingly, nonfed females and fed and nonfed males and nymphs also contained 2,6-DCP, but larvae and eggs did not. Short-range attraction bioassays using various concentrations of 2,6-DCP and its analogs (2,4-dichlorophenol, 4-chlorophenol, and 2-chlorophenol) showed that males were predictably attracted to 2,6-DCP and that 2,4-dichlorophenol acted as a mimic. Surprisingly, nymphs and adult females also displayed attractiveness toward 2,6-DCP. Because 2,6-DCP is a sex pheromone, only the attraction of males is biologically relevant. We concluded that the activation of receptors for detection of 2,6-DCP and biosynthesis of 2,6-DCP takes place during the nymphal stage of development.

Board 29 PHYLOGENETIC ANALYSES OF MOLECULAR AND MORPHOLOGICAL TRAITS INDICATE CRYPTIC SPECIES AND THE REPEATED EVOLUTION OF AN ECOMORPH IN FLORIDA'S *GEOLYCOSA* WOLF SPIDERS. Ting Wu, Samuel D. Marshall, Hiram College, K. Thornburg, and W. Randy Hoeh, Dept of Biological Sciences, Kent State University, Kent OH 44242.
Currently, 15 species of *Geolycosa* have been described based on a limited number of morphological characteristics. The state of Florida has nine *Geolycosa* sp., seven living in scrubs and sandhills across the state. The goals of this project are: 1) to estimate the evolutionary relationships among Floridian *Geolycosa* populations and species and between Floridian *Geolycosa* and *Geolycosa* from the rest of the USA and, 2) to examine patterns in the evolution of the two ecotypes of *Geolycosa*: those that build turrets at the entrance of their burrow and those that don't. We used cytochrome c-oxidase subunit I (COI) DNA sequences and morphological traits in a cladistic analysis. *Geolycosa* (N=488) individuals from a total of 63 Florida scrub sites were collected and identified based on morphological characteristics. Total DNAs were extracted, amplified, and sequenced from 74 individuals representing the species *G. escambiensis, G. micanopy, G. patellonigra, G. x. xera, G. x. archboldi, G. hubbelli, G. ornatipes, G. wrighti, G. missouriensis, G. rafaelana, G. turricola,* and *G. pikei*. Results to date suggest that: 1) Floridian *Geolycosa* are not a monophyletic assemblage, 2) *G. xera, G. escambiensis, G. hubbelli, G. patellonigra,* and *G. micanopy* are not valid species in a phylogenetic sense, and 3) the two distinct ecotypes of *Geolycosa* have evolved repeatedly across the state. We also found evidence that the *Geolycosa* of the entire eastern USA are derived from ancestors in the western Florida Panhandle.

Board 30 A DESCRIPTION OF COURTSHIP, MATING, AND SUBSOCIAL BEHAVIOR IN THE TANZANIAN CHESTNUT TARANTULA *HETEROTHELE VILLOSELA* (ARANEAE, THERAPHOSIDAE, ISCHOCOLINAE). Barbara Vasquez, vasquezb@hiram.edu, and Amanda R. Weigand, weigandar@hiram.edu, Samuel D. Marshall, marshallsd@hiram.edu, J. H. Barrow Field Station, Dept of Biology, Hiram College, Hiram OH 444234.
Spider sociality is a rare phenomenon, being observed in fewer than 0.1% of described species. We will study the reproductive behavior, maternal care, and spiderlings social behavior in a small subsocial tarantula from east Africa. The focal species was chosen because it is a member of a genus that has been observed to exhibit prolonged cohabitation of the female and her offspring. In addition, the genus is phylogenetically enigmatic, having been recently moved between different genera and even families. The current hypothesized placement of this genus places it in a poorly defined group of small and widely distributed tarantula species. Ours will be the second description of the sociality of this genus of tarantula, and one of the few studies of the ethology of the social behavior any tarantula. We have secured 32 wild-caught *Heterothele villosela* from an importer. The spiders were collected in Tanzania. The spiders are being held in 1.0 liter plastic containers with a bark mulch substratum, a piece of bark for a refuge, and a small water dish. The spiders are fed weekly on domestic crickets. The cages are held in a heated room (average temperature 26.6°c) with ambient sunlight for photoperiod. We will pair spiders and videotape the matings. When offspring are produced, we will allow some to remain in the containers with their mothers and we will rear some spiderlings solitarily. We will observe and videotape group feeding behavior and other social interactions, and record growth rates.

POSTER SESSION
BIOLOGICAL; EARTH; EDUCATION; ENGINEERING; ENVIRONMENTAL; PHYSICAL; SOCIAL
10:00 – 11:00AM
KERNS CHAPEL

Board 1 COMPARISON OF DECAY OF RED MAPLE (*ACER RUBRUM* L.) AND RED PINE (*PINUS RESINOSA* AIT.) BOLES AFTER ELEVEN YEARS IN A CENTRAL MASSACHUSETTS FOREST. Adam S. Zorn, zoma@muc.edu (Charles McClaugherty, mcclauca@muc.edu) Mount Union College, 1972 Clark Avenue, Alliance OH 44601.
The purpose of this study is to compare the rate of decomposition of *Acer rubrum* L. and *Pinus resinosa* Ait. boles after a period of eleven years. The study began in 1990 when felled trees of each species were cut into 1-meter sections. The sections were placed in the Harvard Forest, MA with 80 red maple and 87 red pine sections placed in a red maple stand and red pine stand, respectively. The diameter of each bole varies from 15 to 100 cm. The boles were placed so that the entire length of each section was in complete contact with the ground. The logs were left to incubate undisturbed, and sampling from each site was done at 0, 5, and 11 years, with 5 boles being removed at years 0 and 5, and 10 boles being removed at year 11. Using density as a measure of decomposition, the rate of decomposition of each species was measured. The density data from year 5 showed that only 55.4% of the initial density of red maple remained compared to 73.3% of the initial density of the red pine, indicating that red maple decomposes at a much faster rate than red pine. Visual analysis of the year 11 samples supports the hypothesis that the red maple boles decompose at a faster rate than the red pine boles. A few of the smaller diameter samples from the red maple were very decomposed, with some being barely more than a mass of roots and organic material, whereas most of the red pine samples were relatively solid. The densities of the year 11 samples will be determined using displacement. The expectations of the density results are that they, like the year 5 data and visual analysis, will support the hypothesis by indicating that the red maple samples are much more decomposed than the red pine samples.

Board 2 THE IMPACT OF A METROPOLITAN AREA ON THE GROWTH OF DREISSENA POLYMORPHA. Courtney R. Lay, snori75@yahoo.com (Alan

Stam, astam@capital.edu) Dept of Biological Sciences, Capital University, 2199 E Main St., Columbus OH 43209.
The zebra mussel (Dreissena polymorpha) is an invasive species that has significant impacts on freshwater ecosystems in the Great Lakes region of North America. These effects include altering food chains, water quality, and habitat substrate. The objective of this research is to determine what kinds of effects a large metropolitan area poses on the growth of zebra mussels. Shells from 50 individuals were collected from sites upstream and downstream in Alum Creek from the metropolitan area of Columbus, Ohio. The Velmex Tree-Ring Measurement System was used to measure the widths of the concentric growth ridges of the shell. The mean growth of the mussels from the two sites will be compared statistically.

Board 3 COPPER UPTAKE IN ROOTS FROM HYDROPONICALLY GROWN TREE SEEDLINGS. Brandy N. Jones, (Cadance Lowell Ph.D., clowell@csu.ces.edu and Krishna Kumar Nedunuri, Ph.D., knedunuri@csu.ces.edu) Dept Natural Sciences and Mathematics, Central State University, PO Box 1004, Wilberforce OH 45384-1004.
Heavy metals such as copper, cobalt, nickel and zinc from industrial processes can be major soil pollutants. Phytoremediation is a novel method of using natural vegetation to extract pollutants from contaminated soils and sequester them as plant biomass. The objective of this ongoing study was to model copper uptake into four tree species, green ash, white ash, red oak, and sycamore. These tree species are grown on coal reclamation sites in Ohio in poor growing conditions and may be candidates to use for phytoremediation. Copper levels in the nutrient solution for this hydroponic study were 50 to 500 times higher than typical soil extractable copper concentrations (0.4 ppm) found in Ohio. A flood and drain hydroponic system was set up in the Central State University greenhouse. Deionized water was added/drained weekly for one month followed with biweekly treatments of complete nutrient solutions with increasing concentrations of copper. The system consisted of 20 large, 124 L plastic containers filled with perlite. Thirty-three green ash, 33 red oak, 27 sycamore, and 27 white ash one-year seedlings were randomly planted with six trees per container. The trees were allowed to grow for five months in the hydroponic system. The roots were removed from the trees, frozen at 0° C until use. Feeder roots less than 1.0 mm in diameter were dried at 55–60° for 24 h. Dried roots were hand ground in a mortar and pestle, and 0.05 g of the dried material per sample was ashed in porcelain crucibles in a muffle furnace for 4 h at 450°C. Ashes were placed in medium (10–15 µm) glass Buchner funnel with sealed fritted disk and copper was eluted with 10 ml of 2M HCL/1M HNO_3. Samples were diluted with type I water and copper concentrations were measured by atomic absorption spectrophotometry. To evaluate growth and survival, tree height, basal diameter, leaf chlorophyll content, and aboveground biomass were measured.

Board 4 DETERMINATION OF RICE CULTIVAR ROOT EXUDATE VARIATION EXAMINED THROUGH NITRIC OXIDE INHIBITION OF METHANOGENESIS. Christopher P. Beekman, (Rebecca S. Bilek, rbilek@muskingum.edu) Muskingum College, 163 Stormont St., New Concord OH 43762.
Rice is the primary food crop in many areas of the world where population growth is highest. Rice is traditionally grown in fields that are flooded with water shortly after the plants begin to grow. Water cover deters oxygen from reaching the soil, thereby allowing anoxic bacterial metabolic processes to occur. De-methylization of acetate and other organic acids begins shortly after the field is flooded, producing methane, a greenhouse gas. As global dependence on rice increases, identifying mitigation options becomes desirable. Cultivar type has been shown to dramatically influence methane emissions. The primary source of methane precursors (i.e. organic acids) is the rice plant itself in the form of root exudates. This study examines why production of methane varies with cultivar and the effects of the concentrations of root exudates in the soil with depth and cultivar type. Nitric oxide will be used to inhibit methanogenesis, allowing organic acids to accumulate for subsequent analysis by high performance liquid chromatography. Samples of soil pore water and emitted gases will be analyzed by gas chromatography to determine the concentrations of methane and carbon dioxide. In addition, measurements of stable isotope ratios of carbon will be used to calculate the contribution of each methane production pathway and the percent of produced methane that is oxidized. Results will be used to understand why methane emissions differ widely between cultivars grown under identical conditions. Unlike previous soil incubation studies, this investigation will be conducted using actual rice producing plots allowing for a more accurate analysis that includes plant/soil inter-relationships.

Board 6 GEOGRAPHIC DISTRIBUTION OF USERS OF A WEBSITE ON THE ROLE OF WOMEN IN THE ART OF ANCIENT GREECE, Frederick John Kluth, fjk@fjkluth.com 1060 De Leone Drive, Kent OH 44240-2026.
Most media target local users because of logistical problems. Governmental agencies and advertisers provide funding for local users for similar reasons. The emphasis of the Internet may change this. In Nov. 30, 1997 an educational web site was set up on the Role of Women in the Art of Ancient Greece to explore the use of the web. The site allows investigation of the geographic distribution of Internet users. The question is whether Internet uses follow usage patterns demanded by other media. On the menu page of the site users are given the option of registering as a user. As of October 30, 2001, two hundred and nine users have registered with 163 of those users indicating that their residence is the United States of America. Though the site is physically in Ohio only 9 of the registrants indicate Ohio as their location. New York State is the most common location with New York City being the most common city. Forty-six registrants indicated a location in one of 25 foreign countries. The country with the second most registrants was the United Kingdom with 10. The tremendous geographic diversity found requires serious adjustment of funding directions. A national sponsor might be acceptable while an international sponsor might be preferred.

Board 7 SURVEY OF ECONIMIC VALUE OF A CHANNEL RESTORATION PROJECT. Dawn A. Farver, farver.1@osu.edu, The Ohio State University, 590 Woody Hayes Drive, Columbus OH 43210.
An agricultural drainage ditch on Waterman Farm at The Ohio State University (OSU) was the potential site for a channel restoration project. To determine the public support from two different groups of stakeholders, a questionnaire was created to survey their "willingness to pay" (WTP) for channel restoration projects. The channel drains directly into the Olentangy River and, consequently, the focus of the economic surveys was the Olentangy River. The first group of stakeholders, residents living within the watershed, was asked to value channel restoration if the restored channel would reduce the flux of contaminants into the Olentangy River (22 respondents). The second group of stakeholders, members of the OSU community, was asked to value the university's participation in programs incorporating environmental best management practices (52 respondents). It was hypothesized that respondents who frequently participated in recreational activities on or near the Olentangy River would be interested in preserving the area and would, therefore, be willing to pay for measures to protect the water quality of the river. The data collected were summarized in an Access database and a regression analysis was performed. The average number of visits to the Olentangy River per respondent was 11 and the average WTP per respondent was $23-24. From these results, it appears that maintaining the integrity of recreation areas is important to the surrounding community, and that it is important to the OSU community that more environmentally sound practices are implemented on campus.

Board 8 EXCAVATION AND CONSERVATION OF THE HARTLEY MASTODON, COLUMBIANA COUNTY, OHIO. Cheryl P. Mattevi[1], mattevi@salem.kent.edu and Brian G. Redmond[2]. [1]Kent State University Salem Regional Campus, 2491 SR 45 S, Salem OH 44460, and [2]Cleveland Museum of Natural History, Cleveland OH.
The Hartley Mastodon was salvaged July 31, 2001 from a commercial lake excavation in Butler Township, Columbiana County, Ohio. The excavated lake lies within an alluvium area along the headwaters of the Upper Mahoning River, and is associated with a kettle lake within Woodfordian tills. The specimen appears to be a young healthy female, and consists of a total of 87 complete or nearly complete bones, including a nearly intact cranium, mandibles, both tusks, partial pelvic structure, 34 ribs, 29 vertebrae, and 18 foot bones. Although the original material, including the cranium, was not recovered in place, a large vertebral section from C2 through T5 was articulated and associated with ribs and one tusk. Immediately following excavation, the tusks and bone material were wrapped in plastic and stored in a cool place before being washed with a water spray and allowed to dry slowly. The remains, which are stable and generally intact, were found at the surface of a shelly marl layer containing abundant freshwater snails and clams indicating a shallow lake environment. Twigs and beaver-chewed maple branches are closely associated with the mammal, which was covered with only 110 cm of peat deposits. Conservation of the material is a joint project of the Cleveland Museum of Natural History and Kent State University Salem Campus. The specimen is being used as a focus for research at Kent Salem and the Cleveland Museum of Natural History as well as for hands-on scientific investigations in local secondary schools.

Board 9 GEOGRAPHIC PATTERNS OF HOME COMPUTER OWNERSHIP IN THE UNITED STATES. Bruce W. Smith, bsmith4@bgnet.bgsu.edu Yu Zhou, yzhou@bgnet.bgsu.edu Bowling Green State University, Dept of Geography, Bowling Green OH 43403.
Although personal computers have become a fixture in the workplace and the home, not all Americans have equal access to computers. The purpose of this paper is to describe geographic patterns in the ownership of home computers. State-level data from the *Current Population Survey* for 1994 and 1998 are utilized. In 1994, the states with the highest percentages of ownership of home computers were located primarily in the West and Northeast, with Alaska, Utah and New Hampshire leading the nation. In contrast, states in the Southeast were characterized by lower rates. Between 1994 and 1998, the national rate of home computer ownership more than doubled, rising from 24.3% in 1994 to 51.1% in 1998. Despite high growth rates between 1994 and 1998, the states in the Southeast continued to lag the rest of the nation. Simultaneously, high rates of ownership had expanded from the original three states to several other states, including Washington, Oregon, Wyoming, Colorado,

and Delaware. National averages in 1997 showed that the rate of home computer ownership tends to rise as income levels and educational levels increase. For example, nationwide 75.9% of the families with incomes of $75,000 and greater owned a computer in contrast to only 38.8% of those families with incomes in the $25,000 to $49,999 range. In the 1998 *Current Population Survey* data for states, however, income and educational attainment variables were only modestly correlated with state-to-state variations in computer ownership, having correlation coefficients of 0.505 and 0.597 respectively.

Board 10 A PLUTO-CHARON CABLE SPACECRAFT. Francis G. Graham, francisgraham@rocketmail.com Kent State University, 400 E. Fourth St., East Liverpool OH 43920.
The planet Pluto and its moon Charon are mutually tidally locked bodies of near 0.0018 and 0.00018 Earth masses, respectively. Their gravitational fields are weak enough so that a steel cable of tensile strength approx. 2.9 Gpa can be strung over the approx. 17,300 km. distance between the surfaces of their mutually facing hemispheres, and a cable spacecraft could move up and down between them. Allowances on the cable spacecraft system could be made for slight librational effects, thermal differences, and a preliminary design for a small 11,500 kg loaded (9105 kg. empty) cable spacecraft is realistic, transiting between Pluto and Charon in about 15.9 hours. Electromagnetic braking on the cable from electricity generated in fuel cells would make the craft more than twice as energy efficient than a transfer using chemical rockets alone, once a cable system is in place. This is likely the only pair of worlds in our solar system where a cable spacecraft is feasible with only modest advances in materials technology.

Board 11 ILLINOIAN AND PRE-ILLINOIAN STRATIGRAPHY OF THE MILL CREEK VALLEY, HAMILTON COUNTY, OHIO. J. Michael Clinch, mclinch@ehstech.com and Michael D. Morris, EHS Technology Group, P O Box 3040, Miamisburg OH 45343-3040.
Three deep (120'-140') Rotasonic test borings have been completed through a dissected high terrace located along the western margin of the Mill Creek valley, in the Winton Terrace neighborhood in Cincinnati, Ohio. Sediment cores from these three test borings, as well as samples from other conventional test borings were used to interpret the stratigraphy of the area. The tread of the terrace is between 150 and 100 feet above the floor of the modern Mill Creek valley, and slopes towards the valley. The terrace is underlain by four, distinct till layers, separated from each other by a thin-to-thick layer of lacustrine sediments and/or subaqueous fan deposits. Adjacent to the valley wall, the tills are overlain by colluvial sediments. The tills are massive to sheared in places, and crudely laminated in others, suggesting the presence of both lodgment tills and subaqueous flow tills. The upper surfaces of these tills are weathered, and wood fragments are occasionally found in the base of the tills. These relationships suggest that each till is the result of a separate glaciation or stage within a single glaciation, and not the result of minor marginal fluctuation. The uppermost till layer is Illinoian in age, and the deeper tills may be from earlier stages of the Illinoian Glaciation, or from older glaciations. The tills overlie at least two older episodes of lacustrine deposition, separated by an episode of free drainage, represented by the fine-grained sand deposits formerly exposed in a sand and gravel pit. The lacustrine deposits are underlain by non-glacial sediments deposited on the floor of the Deep-Stage valley, which is present beneath the Mill Creek valley. Stratigraphically-significant portions of these cores have been donated to the ODNR core repository, where they are available for study.

Board 12 DRIFT THICKNESS OF OHIO. Michael P. Angle, mike.angle@dnr.state.oh.us Paul Spahr, paul.spahr@dnr.state.oh.us Frank Fugitt, frank.fugitt@dnr.state.oh.us Mike Hallfrisch, mike.hallfrisch@dnr.state.oh.us Ohio Dept of Natural Resources, Division of Water, 1939 Fountain Square Dr., Columbus OH 43224.
The Ohio Dept of Natural Resources (ODNR), Division of Water, Water Resources Section (WRS) has produced a series of statewide geographic information system (GIS) coverages for the unconsolidated (glacial) aquifers of Ohio. Well log and drilling reports, existing geologic maps, soil maps, and bedrock topography and drift thickness maps on file at the ODNR, Division of Geological Survey and the WRS were utilized to construct these coverages. Maps were drawn and digitized using 7.5 minute quadrangle topographic maps at a scale of 1:24,000. The digital coverages were then joined to produce a state coverage. This map depicts a color-ramped derivative map that combines the drift thickness and lithology themes derived from the coverage. These themes are overlayed on a digital elevation model base map of the state, derived from the National Atlas of the United States elevation data set. This map provides a unique means of summarizing Ohio's glacial deposits. This project was funded, in part, by a grant from the Ohio Environmental Protection Agency, under provisions of Section 319 of the Clean Water Act.

Board 13 MODELING OF SEDIMENT TRANSPORT IN RIO PUERCO, NEW MEXICO, USING LINEAR REGRESSION ANALYSIS. Isam E. Amin, ieamin@cc.ysu.edu Dept of Geology/Center for Environmental Studies, Youngstown State University, Youngstown OH 44555.
The Rio Puerco, in central New Mexico, is an ephemeral stream with a drainage area of 7340 square miles. Most of its flow is runoff from rainfall induced by thunderstorms. Diversion of streamflow for irrigation is uneconomical because the Rio Puerco basin has one of the highest suspended sediment concentrations in the United States. Furthermore, the sediments contain toxic heavy metals such as arsenic, mercury, and uranium. The objective of this study is to estimate the sediment load in Rio Puerco using linear regression. Specifically, sediment load, a dependent variable, is estimated as a function of water discharge, an independent variable. Sediment load is estimated on a daily, monthly, and annual basis. The regression procedure is also utilized to relate suspended sediment concentration to daily water discharge. Data used in this study are obtained from Water Resources Data for New Mexico, published by the U.S.G.S. The data cover a period of 32 years and are recorded at the gaging station near Bernardo. Results of the regression analysis are obtained using the SPSS program. The results indicate high correlation coefficients for the daily ($r = 0.95$) and monthly ($r = 0.97$) relationships, a relatively lower coefficient ($r = 0.76$) for the annual relationship, and a poor correlation coefficient ($r = 0.50$) for the sediment concentration relationship. The difference in correlation coefficients is due to the fact that sediment load is highly interrelated with water discharge whereas sediment concentration is primarily related to erosion of the watershed rather than scour of the bed of the main stream.

Board 14 THREE-DIMENSIONAL SURFICIAL-GEOLOGY MAPS OF THE CANTON AND EAST LIVERPOOL 1:100,000-SCALE QUADRANGLES. E. Mac Swinford, mac.swinford@dnr.state.oh.us Glenn E. Larsen, Richard R. Pavey, Gregory A. Schumacher, and Kim E. Vorbau, Ohio Dept of Natural Resources, Division of Geological Survey, 4383 Fountain Square Dr., Columbus OH 43224-1362.
The Ohio Dept of Natural Resources, Division of Geological Survey recently completed two maps depicting the surficial geology of the Canton and the Ohio portion of the East Liverpool 1:100,000-scale quadrangles. Mapping was performed at 1:24,000 scale (48 quadrangles), compiled digitally, and converted into full-color, print-on-demand, 1:100,000-scale, three-dimensional surficial-geology maps. These maps show the thickness and stratigraphic sequence of lithologic units such as till, gravel, sand, silt, and clay from the surface down to and including the uppermost buried bedrock unit. Data sources include county soil surveys, Ohio Dept of Transportation and Ohio EPA boring logs, engineering logs, water-well logs, theses, and published and unpublished reports. New mapping discoveries caused changes in interpretation of the area's geology. Buried valleys beneath numerous tributaries south of the glacial margin contain thick deposits of lacustrine silt down to bedrock; the silt is intermixed with debris flows and fans from the valley sides. Numerous buried valleys thought to be filled completely with sand and gravel actually contain relatively thin deposits of sand and gravel underlain by thick lacustrine silt and debris-flow deposits. Extensive revision of the bedrock topography of Wayne County depicts bedrock much closer to the surface than previously mapped. The Wisconsinan-Illinoian boundary was mapped in greater detail based on soils maps. This project was partially funded by the U.S. Geological Survey, National Cooperative Geologic Mapping Program, STATEMAP component.

Board 15 REVISED BEDROCK TOPOGRAPHY OF THE MECHANICSBURG OHIO QUADRANGLE. Richard J. Wynkoop, rjwynkoo@cc.owu.edu 958 Montrose Ave, Bexley OH 43209.
Updating bedrock topography maps is one of the many functions of the Ohio Dept of Natural Resources (ODNR), Division of Geological Survey. The Mechanicsburg 7.5-minute bedrock topography map presently available was extracted by photo enlargement from the 1:62,500-scale Champaign County bedrock topography map completed in 1978. Since its publication, additional data points have become available from log and boring records of the ODNR Division of Water, the Ohio Environmental Protection Agency (OEPA), and the Ohio Dept of Transportation (ODOT). Since changes could not be made to the original photographically enlarged map, old data points were transferred and verified on a new mylar base map, new data points were plotted, and bedrock topography contours were revised. Interpretation of the new data confirms the presence of the large tributary to the Teays valley system which was shown in the original map. On the new map, however, the valley is deeper and a sharp bend at the Champaign-Clark County line is removed. The map is available as an open-file map at the ODNR Division of Geological Survey, and copies are available to the public on demand. Hydrogeologists and environmental engineers will be able to use this map to make more informed decisions about location, volume and potential production of aquifers and other resources as well as to construct more accurate models of the flow of pollutants that may enter aquifers.

Board 16 FRACTURE AND MACROPORE FLOW IN NUTRIENT/PESTICIDE TRANSPORT TO GROUND AND SURFACE WATER. Julie Weatherington-Rice, weathringtn-rice.1@osu.edu Ann D. Christy, Christy.14@osu.edu Bennett & Williams Environmental Consultants, Columbus OH 43231 and The Ohio State University, Columbus OH 43210.
In glaciated Ohio, researchers have noted nutrients and pesticides can bypass grass and forested filter strips to enter surface and shallow ground water. Agrochemicals have been detected in drain tile effluent, shallow monitoring wells, and stream base

flow, but the delivery mechanisms are not well understood. The Ohio Fracture Flow Working Group has identified fractures in the substratum (C horizons) of 95 soil series in Ohio (81 prime farmland soils) representing ~25 million acres in the Midwest. Macropores formed by biological and physical mechanisms within the soil can also contribute contaminants to drain tiles or fractures in minutes, bypassing the soil's ability to retain the nutrients and pesticides. Most models of chemical transport do not take the effects of fractures and macropores into account, under-predicting delivery rates by a factor of 100 or more. The Root Zone Quality Model (RZQM) can be modified to include fractures and macropores, but errors can still be introduced by the way storm events are represented. Modeling by members of the Working Group have found pesticide transport through macropores to be 2.6 (at 1.0 cm) to 1.5 (at 2.5 cm) times greater under median Midwest storms (with initially high intensity, ending as low intensity rainfall) than when modeled assuming constant rainfall intensity conditions. The difference in results between these two modeling assumptions diminishes with higher rainfall volumes, suggesting that more bypass flow is likely under the typical low volume storm more common in Ohio. These significantly higher than expected transport volumes affect ground and surface water quality in agricultural settings and need to be factored into local management and policy decisions.

Board 17 EFFECTS OF FATHERS INVOLVEMENT ON CHILD'S ADJUSTMENT TO CANCER. Stacy R. Flowers, stcrflwr@Otterbein.edu (Dr. Laura Bennett-Murphy, LBennett-Murphy@Otterbein.edu) Otterbein College, 1 Otterbein College, Westerville OH 43081.

As medical care has become more advanced, children are living longer and fuller lives than in the past. Medical personnel have begun to focus on improving quality of life for chronically ill children and their families. Research examining children's adaptation to chronic illness has clearly delineated the ways in which maternal adjustment, maternal involvement, and family functioning can promote child adjustment to disease. Research by Sawyer et al. has shown that maternal adjustment during the period after diagnosis had a significant relationship with the children's psychological adjustment 2 years after diagnosis. While the effects of mothers' adjustment on child adjustment have been established, relatively few studies have examined the role of fathers. The proposed research will examine the impact of fathers' involvement on a child's adjustment to cancer. More specifically, the research is intended to examine the effect of fathers' coping, fathers' distress, roles in childcare, and household management and how those variables may relate to a child's adjustment. Research could lead to an increase in knowledge that may benefit medical personnel in the treatment of chronically ill children and their families. It is predicted that the more time a father spends with his child(ren), and the better the father's adjustment, the better the child's adaptation to cancer will be. Twenty mother/father dyads will be asked to complete a total of 5 questionnaires that will measure coping, distress, roles in childcare, household management, and perceived child adjustment. Questionnaires will be administered to both mothers and fathers in order to gain a more comprehensive view of how household management tasks are divided when a child is being treated for cancer. In addition, 20 fathers of non-ill children will be matched by child's age, gender, and family socioeconomic status to serve as a control group.

Board 18 AN EXAMINATION OF THE ROLE OF NMDA RECEPTORS AND VDCCS IN ACQUISITION AND RETENTION OF A TIMING TASK. Anna L. Mann, a-mann@onu.edu Jennifer A. Webb, j-webb@onu.edu (Brian Woodside, b-woodside@onu.edu) Dept of Psychology and Sociology, Ohio Northern University, 525 South Main Street, Ada OH 45810.

Long-term potentiation (LTP), an enduring, enhanced neuronal response, is one possible mechanism underlying memory. Two forms of LTP have been identified in the rat brain. NmdaLTP, which decays over a short period, is mediated by the M-methyl-D-aspartate receptor (NMDAR). VdccLTP, initiated by activation of voltage-dependent calcium channels (VDCCs), may represent long-lasting changes at the synapse. Research has demonstrated that MK-801, a drug that blocks nmdaLTP, impairs acquisition of both spatial and non-spatial tasks. Verapmil, a drug that blocks vdccLTP, also impairs long-term retention of spatial tasks. The effects of MK-801 and verapamil vary depending on training schedules, type of task, and timing. Here we hypothesize that MK-801 will impair early performance (short interval), and verapamil will impair later performance (long interval) and retention of bar pressing behavior reinforced on a gradually increasing Fixed Interval schedule. Male Sprague-Dawley rats, 90 days old, individually housed and on a 12/12 reverse light/dark schedule, will be mildly food deprived to 85% of ad lib weight. All animals will be taught to bar press on a continuous reinforcement schedule and then divided into three groups. Thirty minutes before each training session rats will be systemically injected with either saline, MK-801 (.10 mg/kg), or verapamil (10 mg/kg); doses previously demonstrated to block the respective forms of LTP and impair behavioral performance. An initial session will measure any effects of the drugs on baseline bar pressing behavior. Next, animals will be trained in successive sessions using a gradually increasing Fixed Interval schedule. Behavior will be measured as trials to criterion, bar pressing rates, and performance after a five day retention period. Saline animals should learn to delay lever-pressing until close to the end of the interval required for a reward. Impairment will be evident if the rat's lever-pressing rate becomes continuous, as opposed to delayed, or if the lever-pressing extinguishes due to the increasing length of the interval.

Board 19 THE EFFECT OF NMDA RECEPTOR ANTAGONISTS AND VDCC ANTAGONISTS ON ACQUISITION AND RETENTION OF CONTEXTUAL DISCRIMINATION CUES. Julie N. Foster, j-foster@onu.edu Jo Dee L. Kane, j-kane@onu.edu (Brian L. Woodside, b-woodside@onu.edu) Dept of Psychology and Sociology, Ohio Northern University, 525 S Main St, Ada OH 45810.

Two forms of long-term potentiation (LTP), a possible mechanism of memory formation, exist in the rat brain. N-methyl-D-aspartate receptors mediate a transient form of LTP, nmdaLTP, and voltage-dependent calcium channels initiate a longer lasting LTP, vdccLTP. MK-801, a dose that blocks nmdaLTP, impairs acquisition in spatial and non-spatial tasks. Verapamil, at a dose that blocks vdccLTP, impairs retention in spatial tasks. The extent of impairment varies depending on complexity of the task, behavioral paradigm, and timing. The current research examines the effects of MK-801 and verapamil on acquisition and retention of a contextual discrimination task. It is our hypothesis that MK-801 will block acquisition of contextual discrimination cues while verapamil will block retention of the cues. This experiment will be conducted using 90 day old male Sprague-Dawley rats, housed individually on a reverse 12h light/dark schedule. All animals will be mildly food-deprived to 85% of their ad-lib weight during all phases of the experiment. The animals will be trained to bar press in an operant chamber on a continuous reinforcement schedule. After achieving criterion, animals will be divided into three groups: saline, MK-801 (0.1 mg/kg), and verapamil (10 mg/kg). The injections will be administered intraperitoneally thirty minutes prior to training. A baseline session will be conducted to determine if the drugs affect bar-pressing behavior. Subsequent sessions will initiate bar pressing in one of two contextual environments, the standard operant chamber or a chamber altered with a black and white striped card and cedar chip odor. Measures of behavior will include bar pressing frequency rates, trials to criterion, and performance after a five-day retention period.

Board 20 RECRUTING UNDER-REPRESENTED STUDENTS INTO CAREERS IN ENVIRONMENTAL BIOLOGY: THE VALUE OF LONG-TERM RESEARCH EXPERIENCES. Ndate Fall, fall.2@wright.edu, David L. Goldstein, david.goldstein@wright.edu Michele G. Wheatly, michele.wheatly@wright.edu Wesley Jackson, jackson.67@wright.edu Wright State University, Dept of Biological Sciences, Dayton OH 45435.

We describe a program funded since September 1999, by the UMEB (Undergraduate Mentoring in Environmental Biology) program of the National Science Foundation. Our focus is to encourage students from underrepresented populations (ethnic minorities and students with disabilities) to pursue research in environmental science. The mainstay of our effort is to provide students with long-term research experiences (>1 yr). Qualified students are placed in paid positions in funded laboratories. Additional activities include: attendance at Deptal seminars; meeting representatives from academia, industry, and governmental or non-governmental agencies; and seminars providing exposure to skills (e.g. time management, resume writing) and mentors (e.g. minority medical and graduate students) chosen to nurture careers in science. Female applicants have outnumbered males by >3:1, and about 90% of participants have been African–American. Nine students currently work in laboratories ranging from environmental toxicology to physiology of stress to experimental psychology. Early results of our program include several recent graduates who have continued on to graduate school in plant ecophysiology, parasitology/immunology, and environmental policy. The retention of some of these students at Wright State has increased minority enrolment in our graduate program by about 50%. In the future, longitudinal data will compare career trajectories, including entry to scientific professions and graduate schools, of UMEB students with their peers who did not participate in the program.

Board 21 CHARACTERIZATION OF METALLO-b-LACTAMASE L1. R. Yates, G. Periyannan, M. W. Crowder crowdemw@muohio.edu Dept of Chemistry and Biochemistry, Miami University, Oxford OH 45056.

Since the introduction of antibiotics in the early part of the last century, the problem of bacterial resistance to antibiotics has challenged physicians and medical researchers alike. Currently, some bacterial infections are unaffected by commonly prescribed antibiotics that were once used to treat patients suffering from bacterial infection. Specifically, several cases have been reported of ampicillin-resistant *E. coli* infections, methicillin-resistant S. aureus infections, and carbapenem-resistant *P. aeruginosa* infections. Initial research has implicated B-lactamase enzymes as integral componenets of bacteria that exhibit resistance to two major antibiotics, penicillins and cephalosporins. Metallo-b-lactamases, a subgroup of the b-lactamase family of enzymes, characteristically bind two Zn(II) ions that are integral to their tertiary structure and ability to lyse b-lactam bonds. These are integral to the functioning of both penicillins and cephalosporins. The characterization of the metallo-b-lactamase L1 was two fold: First, Co(II) substituted L1 enzyme was created under anaerobic conditions. Subsequent Nuclear Magnetic Resonance (NMR) and Ultraviolet-Visible (UV-Vis) spectroscopic studies of this Co(II)-substituted enzyme were used to investigate the metal binding sites of L1. The NMR spectra showed paramagnetically-shifted 1H resonances from 40 to 100 ppm relative to the resonance of solvent water; five of the peaks were attributable to His N-H protons. UV-Vis studies showed Co(II) ligand field transitions from 500 to 650 nm. Further characterization of L1 focused on

the creation, overexpression, and purification of four mutant L1 enzymes: H84C, H86C, H89C, and H160C. Transformation of the plasmid into E. coli allowed for overexpression of all four mutant enzymes; however only the H84C and H89C mutants were successfully purified. The H84C and H89C both bind 1 mol Zn (II)/mole enzyme, and the Kcat value for H89C, 33 +/- 4 s-1 is significantly different from the wild type L1 enzyme. The H84C and H89C mutants allow for the preparation of Co(II)-Zn(II) and Zn(II)-Co(II) analogues of L1 and now allow us to investigate the role(s) of each metal ion separately.

Board 22 THE DEVELOPMENT OF A METHOD TO EXAMINE THE COMPONENTS OF THE SURFACE OF POWDERED PARTICLES. Clark Michael Rosenberry, crosenberry@jcu.edu Michael P. Setter, msetter@jcu.edu Box 100, John Carroll University, 20700 North Park Blvd., University Heights OH 44118.
This paper describes one step in developing a general procedure to detect the surface components of powdered particles without any interference from the components under the surface. This information can be used to determine how the surfaces of these powder particles affect the interactions between the particles and their environment. The complete procedure involves the controlled dissolution of just the surface layers of a particle and examining the resulting solution. The purpose of this investigation is to determine if electrochemistry would be useful in examining these solutions. The primary techniques used in these experiments were Cyclic Voltammetry and Linear Sweep Voltammetry for qualitative identifications plus Linear Sweep Stripping Voltammetry and Differential Pulse Stripping Voltammetry for quantitative determinations. The general procedure for the research was to prepare standard nitric acid solutions and then run a series of tests using a CV-50W Voltammetric Analyzer from Bio Analytical Systems. The various instrumental parameters were optimized for the CV-50W Voltammetric Analyzer through pareto analysis and simplex optimizations involving 159 trials. The working electrode used for these experiments was a glassy carbon electrode with a thin mercury film formed in situ. It has been determined that it is impossible to detect iron in dilute nitric acid solution with the procedures used in this research. However, it has also been determined that copper in solution can be detected under these conditions with a detection limit of 1 ppm. Future work will involve quantifying the change in the copper calibration curve as a function of the concentration of the nitric acid. Once completed, this will allow the determination of solution conditions that will not dissolve copper (II) oxide powdered particles.

Board 24 PHYSICO-CHEMICAL COMPARISON OF AN OVER-THE-COUNTER SUPPLEMENT OF DEHYDROEPIANDROSTERONE (DHEA) TO PURIFIED DHEA. Feguens Bataille, fbataille@wilmington.edu Nicole Chamberlain, Utkarsh Acharya, (Donald Troike, don_troike@wilmington.edu) Dept of Biology, Wilmington College, 251 Ludovic St., Wilmington OH 45177.
DHEA, a hormone with androgenic and estrogenic effects, is secreted by the adrenal gland, and is believed to enhance a wide range of physiological functions, including immune and nervous functions and fat metabolism. Because the secretion of DHEA declines with advancing age, a market for an over-the-counter (OTC) formulation of this hormone has developed among older adults. A previous study demonstrated that purified DHEA (Sigma Chemical) significantly elevated serum sodium concentrations in male mice. If true in humans, older adults taking OTC-DHEA could be subject to elevated blood pressure. Preliminary studies indicate that the same dosage of an OTC-DHEA preparation (derived from plant sources) does not have the same effect. These results caused us to wonder whether the two compounds are chemically the same. An OTC brand of DHEA in a base of cellulose, calcium carbonate and gelatin was dissolved in chloroform to extract the DHEA. The chloroform fraction was evaporated and the recovered solid's melting point was determined and compared to purified DHEA (Sigma Chemical). Repeated samples showed no consistency, which probably reflects the presence of impurities. Infrared spectrometric analysis of three samples demonstrated, however, much similarity between the Sigma DHEA and the OTC-DHEA extract in functional groups and their location. NMR data analysis will be completed.

Board 25 A TEST FOR AGGREGATIVE BEHAVIOR IN THE ARBOREAL ASIAN TARANTULA *POECILOTHERIA REGALIS* (ARANAEA, THERAPHOSIDAE, SELENOCOSMIINAE). Melissa M. Varrecchia, varrecchiamm@hiram.edu Barbara Vasquez, vasquezb@hiram.edu Samuel D. Marshall, marshallsd@hiram.edu J.H. Barrow Field Station, Dept of Biology, Hiram College, Hiram OH 44234.
We examined aggregative behavior in the arboreal tarantula *Poecilotheria regalis* (Aranaea, Theraphosidae, Selenocosmiinae). This experiment was designed to test for mutual attraction (or repulsion) in group-reared spiders placed in groups in experimental containers with an equal number of spiders as retreats. The test spiders were captive bred and raised in groups of ten. The current studies were conducted when the spiders were approximately 1 year old. Each spider was individually paint-marked and placed into a 15 cm by 15 cm by 18 cm tall plastic container, in groups of four. In each of the four corners of the container there was a vertically-oriented retreat made of a clear plastic tube 2 cm wide and 10 cm long, open on both ends. We tested a total of 20 groups of 4 spiders each. Each morning for five mornings all spiders were located and their location (retreat number) was noted. For the first morning's census, most spiders were grouped (66 out of 80). When we tested the condition of all spiderlings (solitary, or in a group of two, three, or four) against an expectation of random retreat choice we found no significant difference (chi sq. = 5.25, 3 df). While there was no evidence for mutual attraction based on an expectation of random settlements in a retreat, there was no repulsion either. We did find that this tendency to settle in retreats randomly in regard to group size changed across the five days, with spiderlings more often solitary or in smaller groups by the fifth morning.

Board 26 THE EFFECT OF SILTATION ON DISTRIBUTION OF ZEBRA MUSSELS (*DREISSENA POLYMORPHA*) IN ALUM CREEK, WESTERVILLE, OHIO. Danielle L. Konfal, dnllknfl@otterbein.edu (Michael A. Hoggarth, Mhoggarth@otterbein.edu) Otterbein College, Otterbox 10806, Westerville OH 43081.
Zebra mussels (*Dreissena polymorpha*) were accidentally introduced into the United States in 1986. Since then, they have been classified as a nuisance species because: 1) they are introduced; 2) they form large populations; and 3) they out-compete native species. In Ohio, zebra mussels were originally found in Lake Erie. Since then, they have spread to rivers and creeks, including Alum Creek in Westerville, Ohio. This study examines the microhabitat of zebra mussels in a creek, relative to flow characteristics. Changes in flow affect the amount of silt deposited on the substrate in a creek. The distributions of zebra mussels at two sites on Alum Creek are being determined by quadrat sampling. Turbidity, sedimentation rates, depth, and flow characteristics are being measured at each of these sites. If zebra mussels are limited by high amounts of silt deposition, then we would expect them to be absent in pool habitats where silt deposition is greatest, and present in riffle and run habitats where deposition is less. Initial observations have shown that zebra mussels were not found on the tops of rocks in pool habitats where settlement rates of silt were high. However, they were found on the top surface of rocks in riffle habitats where silt deposition was less.

Board 27 MACROINVERTEBRATE COMMUNITY COMPOSITION AND ABUNDANCE IN TWO OHIO PONDS. Phirin Lorth, Lorth_P@denison.edu (Dr. Jessica Rettig, Rettig@denison.edu) Slayter Box 1616, Denison University, Granville OH 43023.
Macroinvertebrates such as snails, clams, insect larvae, and worms, are common members of pond ecosystems, where they inhabit macrophytes and the pond bottom. Macroinvertebrates may be important consumers of detritus and plants and may serve as food for other invertebrates or fish. The purpose of this research was to examine the dynamics of the macroinvertebrate community in Ebaugh and Middleton ponds on Denison University's campus, Granville, Ohio. These ponds contain distinctly different macrophyte communities. While a low growing layer of *Najas gracillima* dominates Middleton, Ebaugh contains mixed beds of submerged macrophytes that fill the water column. Thus, the macroinvertebrates that inhabit these plants are likely to differ. From late May through late July 2001, eight macroinvertebrate collections were made in each pond, approximately every two weeks. For each collection a sweep net was used to sample invertebrates from an approximately half meter square area of the pond bottom. Each sample was sorted to separate the macroinvertebrates from plants and detritus. Invertebrates were identified, counted, and preserved in 95% ethanol. Invertebrates common to these ponds included snails (*Gyraulus* and *Physella*); Odonata, Ephemeroptera, Diptera, and Coleoptera larvae; Hemiptera and Coleoptera adults; leeches and other annelids; crustaceans; and flatworms. Results are not yet complete, however, it appears that macroinvertebrates are more abundant in Ebaugh pond than in Middleton pond, probably due to the vast difference in abundance of macrophytes that inhabit each pond. Ebaugh pond also appears to contain a wider diversity of macroinvertebrates than Middleton pond.

Board 28 HIGH TEMPERATURE EFFECTS ON PHYSIOLOGICAL AGE IN THE CORIXID *SIGARA MATHESONI*. Elizabeth A. Kreakie, ekreakie@hotmail.com Stephen W. Chordas III, chordas.2@osu.edu Richard L. Stewart Jr., rstewart@malone.edu) Malone College, Dept of Natural Sciences, 515 25th St, Canton OH 44709.
Sigara mathesoni is a cold water corixid that lives mainly in Canada and the northern United States. It has recently been found in a spring in Killbuck Marsh near Wooster, Ohio. This spring ranges from 8-11°C throughout the year. The average temperature during the winter months is 9°C and 10°C in the summer months. This species appears restricted to these waters in Ohio. The purpose of this project is to explore the physiological affect of exposure to warm temperatures. We compared survival of specimens at differing temperatures under laboratory conditions and observed that at higher temperatures *S. mathesoni* dies more quickly. At room temperature, approximately 24°C, mortality was only 2% after 3 days and mortality was 100% after 5 days. This is in stark contrast to the sample placed at 10°C. Mortality was miniscule (2%) after a three-week period. This leads us to believe that either the metabolism of these insects may increase at high temperatures far above their basal metabolic rate, resulting in starvation, or that the metabolism stops at higher temperatures because the enzymes cannot function in such a wide temperature range. In order to see if the metabolism stops or increases we will place *S. mathesoni* at 3 different temperatures; normal (10°C), warm (24°C), and median (17°C). Every other day, a number of live *S. mathesoni* will be removed from each container and frozen at -70°C. Later these will

be tested for both lipid and glucose levels by dissolving the lipids and glucose into solution and inducing a color change within these compounds detectible by a spectrophotometer. This should allow us to determine the decline rate in different temperature groups. If these compound levels in the higher temperature groups show a faster decline this may indicate that the water temperature causes the metabolic rates of *S. mathesoni* to increase well above their basal rate. If there is no change in their metabolic reserves their metabolism likely shuts down due to lack of enzymatic activity.

Board 29 LOCALIZATION OF A PUTATIVE NA-K-2CL COTRANSPORTER IN *MANDUCA SEXTA* TISSUES. Neal Heilman, Heilmann@kenyon.edu Christopher M. Gillen, Gillenc@kenyon.edu Dept of Biology, Kenyon College, Gambier OH 43022.
The Na-K-2Cl cotransporter (NKCC) is a membrane bound protein (~200 kDa) found in a variety of plant and animal tissues. It has 12 membrane spanning domains, cytoplasmic N and C termini, and is well conserved among species. NKCCs are known to play a role in transepithelial ion movement, cell volume regulation, and intracellular chloride ion concentration. Two isoforms have been identified in vertebrates. NKCC1 is a widely-distributed isoform found on the basolateral membrane of secretory tissues. NKCC2 is found in absorptive cells of the kidney. This study examined the pattern of tissue expression of a putative NKCC in the tobacco hornworm, *Manduca sexta*, testing the hypothesis that NKCC is restricted to the Malpighian tubule. Malpighian tubule, midgut, nerve, fat, and salivary gland tissues were examined for the presence of NKCC by denaturing gel electrophoresis and western blotting, using a polyclonal antibody that we have developed against a C-terminal region of the *M. sexta* NKCC. The antibody strongly recognized proteins from Malpighian tubule and midgut membrane preparations that migrated at ~90 kDa and ~200 kDa. Based on densitometry, antibody reactivity was 36±23% (mean±S.E., N=3) greater in the midgut than in the Malpighian tubule. A similar pattern was observed in salivary gland membranes at much lower intensity. The expression pattern of the putative NKCC in several tissues of *M. sexta* is similar to the pattern of vertebrate NKCC1 expression.

Board 30 ZOOPLANKTON ASSEMBLAGE DYNAMICS IN TWO OHIO PONDS. Linda S. Schuman, schuma_l@denison.edu (Jessica Rettig, rettig@denison.edu) Slayter Box 2405, Denison University, Granville OH 43023.
Zooplankton, tiny crustaceans and insects that live in ponds and lakes, are a vital link between producers and consumers in the food web of aquatic ecosystems. This study compared zooplankton composition and species abundance in two Ohio ponds, sampled throughout the early summer. Ebaugh Pond and Middleton Pond are located on the campus of Denison University, Granville, Ohio. Ebaugh is stream-fed and also receives runoff that may contain fertilizers. It contains abundant macrophyte beds and has little open water. Middleton is a spring-fed pond. The surrounding land is fallow and runoff does not contain fertilizers. There are very few macrophytes in Middleton and most of the pond is open water. Because these ponds differ in their level of macrophyte coverage and nutrient input, it was proposed that the zooplankton assemblage in each would differ during the sampling period. Zooplankton were collected once a week from May 29, 2001 to July 23, 2001. Three zooplankton samples were collected via a vertical tow using an 80-micron net from the deepest point in each pond. Zooplankton samples were preserved using Lugol's solution. In the lab, zooplankton were processed by identifying and counting individuals of each taxa present in a sub-sample of the original sample. Each pond contained a diverse assemblage of zooplankton taxa with a high degree of species overlap between the ponds. Nine species were found in Ebaugh, and seven of these species were also found in Middleton. Total zooplankton density in the two ponds did not differ during the study.

POSTER SESSION
PRE-COLLEGE STUDENTS
1:30 – 3:00 PM
KERNS CHAPEL

Board 1 THE EFFECT OF ENVIRONMENT ON PIG CORPSES. Jessica E. Hall, Jazzbo4255@AOL.com 2655 46th St., Canton OH 44705 (St. Thomas Aquinas High School, Louisville).
This project is based upon research at the University of Tennessee Anthropological Research Facilities founded by Bill Bass. If a pig corpse is protected from elemental and animal disturbances then it will decompose at a slower rate. Research and advice from the Stark County Coroner's office determined that *Sus scrofa* (domestic farm pig) should be used because its skin has sparse hair and its fat-muscle ratios are close to a human's. This allows these observations to be applied loosely to humans. Cow tongues were used to study effects on exposed muscle. Three shoulder/hip to hoof sections of the *Sus scrofa* and three cow tongues were obtained from The Bevington Meat Market in Canton, OH. A wire cage was constructed to protect one pig leg and one cow tongue from large animal interference during exposure to elements. One pig leg and one cow tongue were placed in a shallow grave three feet deep. The remaining pig leg and cow tongue were exposed to animal and elemental disturbances. Each specimen was observed and weighed weekly for five months (from Oct. 6- Mar. 23). Specific stages were observed in the specimens. *Rigor mortis*, bloating, insect eggs and larva, and liquefied tissues exuding from the remains were observed in the protected and exposed pig corpses. *Rigor mortis*, bloating, and adipocere were observed in the buried pig corpse. The exposed pig corpse was completely skeletonized and the bones were scattered by animals within a 10-week period. The final mass of the protected corpse was 13 pounds (a total loss of 12 pounds). Final mass in the buried pig corpse was 30 pounds probably due to water retention. All of the tongue specimens disappeared, probably carried off by animals, most likely opossum and fox due to tracks and other evidence observed. The pig corpse that is protected from elemental and animal disturbances will decay at a slower rate than the pig corpse that is left unprotected. This research is applicable to criminology and the forensic sciences.

Board 2 THE EFFECTS OF PREVIOUSLY EXPRESSED STRESS PROTEINS ON THE OXIDATIVE STRESS RESPONSE OF *SACCHAROMYCES CEREVISIAE*. Adam D. Clark-Joseph, AdamCJ1@aol.com 2341 McCoy Rd., Columbus OH 43220 (Upper Arlington High School).
The stress responses of *Saccharomyces cerevisiae* to many different kinds of stress are similar, particularly with regard to the formation of stress proteins. To test if stress proteins synthesized in response to non-oxidative stresses provide protection against oxidative stress, high and low temperature shocks (39°C for 60 min and 4°C for 30 min) and high and low pH shocks (pH 9.7 and pH 3.3, both for 30 min) were applied to *S. cerevisiae* cells. To provide a secondary, oxidative shock, 0.5ml of 1.0% hydrogen peroxide was added to half the cells from each of these single-stress environments. Ten plates of *S. cerevisiae* were exposed to each set of conditions; 10 plates had only high temperature shocks, 10 plates had high temperature shocks and oxidative stress, and so on. The double shock results were then compared with the corresponding single-shock results. Oxidative stress corresponded to a statistically significant change, a decrease, only in *S. cerevisiae* which had been previously exposed to a low pH shock, where a T-test yielded a p-value of .0300. The controls and other cells exposed to non-oxidative stresses did not change in a statistically significant manner in response to oxidative stress; all the corresponding p-values were between .4 and .7. Thus, the results of the experiment were inconclusive, though they suggest that low pH shocks may not induce stress protein synthesis.

Board 3 ROAD MORTALITY OF SNAKES IN THE KILLDEER PLAINS WILDLIFE AREA. Nathan J. Yaussy, nyaussy@yahoo.com 5051 N. Galena Road, Sunbury OH 43074 (Buckeye Valley High School).
The eastern plains garters (*Thamnophis radix radix*) and eastern massasauga (*Sisturus catenatus catenatus*) are listed as endangered on Ohio's threatened and endangered species list and found in Killdeer Plains Wildlife Area in Wyandot County, Ohio, USA. Killdeer Plains also provides habitat for the Kirtland's snake (*Clonophis kirtlandii*), listed as threatened, and the smooth green snake (*Liochorophis vernalis*), status unknown. Serious concerns exist regarding a decline in numbers of threatened and endangered snakes at Killdeer Plains. Observations during fieldwork at Killdeer Plains have indicated that virtually all species of snakes native to the area are frequently killed by vehicular traffic. A systematic survey of road kills had not been conducted at Killdeer Plains. Thus knowledge of population distributions is incomplete and actual impact that vehicular traffic may have upon snakes, such as seasonal effects, was unknown. This study was conducted in cooperation with the Ohio Department of Natural Resources in three surveys: late August to early November 2000, late March to early June 2001, and late August to early November 2001. All roads in the Killdeer Plains Wildlife area were driven twice a week. Dead snakes were collected, identified, and location recorded by Global Positioning System (GPS). Live snakes were identified, location recorded by GPS, and assisted off the road. The number of snakes found on the roads on each collection day in each collection period was not uniformly distributed. The days of the greatest activity were not the same for all species of snakes and may be linked to temperature shifts in all periods of collection. More snakes were found on specific sections of road than on others. In the fall of 2000, 199 snakes were found. There were 84 brown snakes (*Storeia dekayi dekayi*), 84 eastern garter snakes (*Thamnophis sirtalis sirtalis*), one milk snake (*Lampropeltis triangulum triangulum*), five eastern plains garters, two eastern massasauga, three Kirtland's snakes, 13 northern water snakes (*Nerodia sipedon sipedon*), and seven redbelly snakes (*Storeia occipitomaculata*). In the spring of 2001 there were ten brown snakes, 20 eastern garter snakes, one eastern plains garter, six northern water snakes, one black rat snake (*Elaphe obsoleta obsoleta*) and one redbelly snake for a total of 39 snakes. The fall 2001 survey produced 150 snakes, with 58 brown snakes, 57 eastern garter snakes, one Kirtland's snake, one milk snake, six eastern plains garters, three redbellys, and 24 northern water snakes. Road survey results were compared with a tile survey also conducted at Killdeer Plains. A tile survey is where metal corrugated roof tiles are put in fields to attract snakes. The tiles are periodically checked for snakes. In the tile survey of 2000, there were 12 brown snakes, 766 eastern garters, three milk snakes, two Kirtland's snakes, 27 massasaugas, 6 northern water snakes, and three smooth green snakes. This illustrates

the differences in habits of species of snakes. The fall 2000 road survey data led to the discovery of new populations of eastern plains garter snakes.

Board 4 HOW DO COMMERCIAL DE-ICER PRODUCTS AFFECT THE PHYSIOLOGY OF *DAPHNIA MAGNA*? Tricia M. Yerardi, triciayerardi@myownemail.com 124 Rinkliff Ln, Chillicothe OH 45601 (Unioto High School).
Ice removal from roads is difficult and leads to the use of de-icer products. However, there may be adverse effects on the physiology of animals. This study explored the effects of various concentrations of commercial de-icer products on the heart rate and swimming motions of the freshwater crustacean *Daphnia magna*. Freshwater was the control. Hypotheses were: (1) *Daphnia magna*, that are exposed to weak (1%) solutions of commercial de-icer products, will have no observable changes in heart rate or swimming motions; (2) *Daphnia magna*, that are exposed to medium (5%) solutions of commercial de-icer products, will have an increase in heart rate and swimming motions, and (3) *Daphnia magna*, that are exposed to strong (10%) solutions of commercial de-icer products, will have a decrease in heart rate and swimming motions, and possibly die. Solutions were freshwater, Prestone Windshield De-Icer Washer Fluid™ (Prestone De-Icer), Prestone Driveway Heat™ (Prestone Heat), Road Runner Ice Melt (Ice Melt), and Diamond Crystal Salt™ (Salt). Three different specimens were used for each solution. Results were: (1) The heart rate of the *Daphnia magna* in 1% Prestone De-Icer was not affected. All other solutions decreased the heart rate and caused erratic swimming movements in the Daphnia magna; (2) None of the *Daphnia magna* in 5% solutions had an increase in heart rate. The swimming movements in all solutions were affected, first with erratic movements and then a decrease in movement; (3) All *Daphnia magna* in 10% solutions had decreased heart rates. All specimens died in 10% solutions of Prestone Heat and Ice Melt; one specimen died in 10% salt solution. Small disturbances in the *Daphnia magna*'s environments may have profound consequences on their populations. De-icer products should be used in the least amount possible for limited time to decrease stress on the *Daphnia magna*'s life cycle.

Board 5 THE POTENTIAL FOR THE USE OF RADISH IN SOIL PHYTOREMEDIATION. Ericka K. Johnson, shorty_hopes@hotmail.com 9884 Foundry St, East Liberty OH 43319, Anna R. Stormer, 03stora@benlogan.k12.oh.us (Benjamin Logan High School).
Phytoremediation is an alternative solution for cleaning toxic soils and waters. Hyperaccumulators remove contaminantes from toxic sites. Plants degrading, containing or stabilizing pollutants act as filters or traps. Contaminantes remediated in this manner include: heavy metals, solvents, pesticides and nuclear wastes. Hyperaccumulators, including *Thlaspi goesingense*, *Alyssum lesbiacum,* and *Cardaminopsis halleri,* are grown and often harvested at a low cost providing an environmentally friendly remediation method. This research involved examining the common radish *(Raphanus sativus)* for possible use as a hyeraccumulator in phytoremediation. Radishes were grown in soils contaminated with copper and zinc. The copper was at levels of 0 to 800 parts per million. Zinc was at levels of 0 to 3200 parts per million. Metal content within the radish was analyzed by dry ash oxidation, diethydithiocarbamate was added to develop a color reaction and read in a Spec20D. Results were compared to standard solutions. The control plants were found to contain 5 parts per million copper in the leaves and experimental leaves contained between 5-8 parts per million. The control roots 14 parts per million of copper, while the experimental roots contained 16 and 52 parts per million. The control for zinc roots was found to have 13 parts per million and experimental roots levels were between 12-21 parts per million. Controls plants were found to have 2 parts per million for zinc while testing levels were 4- 7 parts per million. It was concluded that zinc does not look to be a promising candidate to be remediated by radishes and further testing will be necessary to draw conclusions regarding copper.

Board 6 TOTAL PLATE COUNT OF HETEROTROPHIC MESOPHILIC BACTERIA FOUND IN GROUND BEEF HAMBURGERS USING CONDIMENTS AS A VARIABLE IN COMMERCIAL OUTLETS IN COSHOCTON, OHIO. Amy C. Schlegel, dschlegel@coshocton.com 1900 Atwood Terrace, Coshocton OH 43812 (Coshocton High School).
The objective of this study was to see if hamburger samples with condiments from Burger King and Wendy's fast food restaurants in Coshocton, Ohio, would demonstrate marked differences in their total plate counts of heterotrophic mesophilic bacteria. Four cooked hamburger samples from Coshocton, Ohio, Burger King and Wendy's fast food restaurants (one plain, one with only mustard, one with only lettuce, and one with all of the toppings) were all diluted using sterilized water to a 10:-3 dilution. After their inoculation, the trypticase soy agar plates were placed under a 60 WATT lamp at 37°C and read at 24, 48, 72, and 96 hours once a month for eight months. All samples had more than 250,000 CFU's (colony forming units) per ml. In the months of June, September, and October samples were too numerous to count (TNTC). Samples from July and August had the lowest number of CFU's per ml. During November, December, and January the total plate counts rose considerably at 96 hours. This project demonstrates the need to maintain a healthy food supply so that food borne illnesses may be reduced.

Board 7 WHICH MATERIAL GENERATES A SPARK THE QUICKEST? Elizabeth K. Stirbens, kstirbens@neo.rr.com 12280 Beeson St., Alliance OH 44601 (Marlington Middle School).
In this experiment, a static electricity generator was built to figure out "what material generates a spark the quickest?" Twenty materials including alpaca wool, faux fur, towels with and without fabric softener, and carpet were tested five times each, to see which could generate a spark in the quickest amount of time, by creating friction between the materials and the machine. The amount of time it took for a fabric to spark was recorded when or if a material sparked. Through this research, the hypothesis was that the cotton towel dried without fabric softener would create a spark most quickly. Standard for all trials were the maximum amount of time for trial, speed and direction of drum rotation, pressure of material against the drum, and size of material tested. The variable was the different materials used. This experiment showed that the material which generated a spark most quickly was the 100% cotton washcloth. Sixteen other materials took varying longer amounts of time. Three materials that never sparked were the 100% polyester fabric, the nylon netting, and "Swiffer"™ dusting sheet. This experiment rejected the hypothesis. The 100% cotton washcloth sparked in the quickest amount of time, not the towel without anti-static fabric softener. This might be because the washcloth has more protruding threads of fabric than the towel, therefore giving off more of a charge in the process than the towel. This experiment is important to society because it demonstrates how to contain electricity, illustrates just how powerful static electricity can be, and shows which materials are effective and ineffective at preventing static electricity for the carpet and clothing industries.

Board 8 EFFECT OF NERVE GROWTH FACTOR ON NITRIC OXIDE SYNTHASE PROMOTERS IN GENES OF RATS AND HUMANS IN PC12 CELLS. Zeeshan A. Qureshi, zeeshan_q14@hotmail.com 2993 Brandon Rd., Upper Arlington OH 43221 (Upper Arlington High School).
Nitric Oxide (NO) is a neurotransmitter with significant influence on the Central Nervous System (CNS). The enzyme Nitric Oxide Synthase (NOS) forms NO and is regulated by gene NOS1 or nNOS in neurons. Rats and humans are thought to bear strong DNA sequence similarities in exons of the NOS1 gene. The objective of this project was to find similarities in mechanism between human and rat NOS1 using model rat pheochromacytoma (PC12) cells. When induced by the protein Nerve Growth Factor (NGF), PC12 cells morphologically differentiate into neurons. In this experiment, endogeneous rat NOS1 gene was an internal control, human NOS1 without NGF was the control, and human NOS1 with NGF was the experimental. PC12 cells transfected with human NOS1 promoter region via retroviral vector were obtained from the lab. Cells received NGF treatment for eight days and were then harvested. Total RNA was isolated and cDNA templates were obtained from mRNA through Reverse Transcriptase (RT) reaction. The cDNA templates were amplified under PCR and placed under agarose gel electrophoresis. PCR product formation of rat NOS1 of size 282 bp with NGF was greater than that of rat NOS1 without NGF. PCR product formation for human NOS1 transgene of size 450 bp with NGF was also greater than that of NOS1 transgene without NGF. Data suggested that NGF induced an up-regulation in NOS1 gene expression in humans. Results from this experiment can be used to provide a greater understanding of nitric oxide regulation in the CNS.

Board 9 UTILIZING DNA FINGERPRINT ANALYSIS IN FORENSIC ENTOMOLOGY. Jacob Bryan, JacobBryan@adelphia.net 10153 Regatta Trail, Aurora OH 44202 (Twinsburg High School) and Britt A. Bunyard, Ursuline College.
Forensic pathologists are often required to determine time and cause of death during autopsy. The most precise method to date for identifying postmortem interval is by determining the specific species of insect larvae found on a corpse. Within hours (or even minutes) of death, necrophilic flies ("blowflies" and "flesh flies") lay eggs on the corpse. Certain species lay their eggs at different times within the decay cycle. In the past, fly larvae had to be reared to maturity before it was possible to determine the species because of similar larval appearance. To identify the species of larvae more quickly, we have utilized DNA analysis techniques. Between the fall of 2001 and spring of 2002 mitochondrial DNA was isolated from at least 12 adults from three species of necrophilic flies from the family Calliphoridae (*Calliphora vicina, C. vomitoria,* and *Phaenicia sericata*). Then using polymerase chain reaction (PCR) we amplified the cytochrome b oxidase subunit 1. Restriction enzyme analysis was carried out on mtDNA PCR products. Based on RFLP differences between species, we were able to unambiguously identify the adult (and larval) stages of necrophilic flies.

Board 10 THE EFFECTS OF *IN VITRO* STRESS ON THE MORPHOLOGY AND SUSCEPTIBILITY OF *CANDIDA ALBICANS*. Timothy A. Cook, TimCook2002@aol.com 8671 SR 7, Proctorville OH 45669 (Fairland High School).
Many organisms are known to exhibit morphological changes when subjected to stress. *Candida albicans*, a member of the Fungi Imperfecti and a common human parasite, is known to have two forms. The blastospore is the more common and is prevalent at temperatures below 37° C; the germinated form is usually seen only above 37° C. The main goal of this study was to determine morphological changes brought about from starvation, pH, and povidone iodine (PVP-I) stress in *C. albicans*. Cells were incubated at pH levels 6.3, 7.3, and 8.3 at both 25° C and 37° C. A minimal salts broth was used to subject the fungi to starvation. Weekly plate counts were made to determine how cell numbers changed over a seven-week period. Weekly

minimal inhibitory concentration tests were performed using 5% PVP-I. Cells from the tube representing the highest tolerated concentration of PVP-I were stained with FUN-1 and Calcofluor White M2R, then viewed using laser scanning confocal microscopy. Data from the viable plate count tests concurred with the viability data from the FUN-1 stain. Morphological analyses showed that the cells tended to become more resistant as cell surface area increased due to lower intracellular antimicrobial concentrations. Viable plate counts showed that the cells become more tolerant because they are exposed to a lower amount of the antimicrobial agent as the *C. albicans* population increases in size. The effect of starvation on the maximum tolerated pressure is currently being investigated by using atomic force microscopy.

Board 11 A COMPARISON OF SOURCE AND WATERSHED QUALITY: MIAMI-ERIE CANAL AND GREAT MIAMI RIVER. Erin E. Sauer, dead_possum107@yahoo.com 5185 Red Bird Ln., Hamilton OH 45011-2018 (Ursuline Academy High School).
The Miami-Erie canal stretches across Ohio from Lake Erie to Cincinnati. A portion of this canal branches from the Great Miami River, runs for approximately 1.7 miles past a power plant, and flows back into the river. It is possible that pollution could enter the river, or water quality could be improved from this canal diversion. I hypothesized that the water quality would improve from the diversion due to protected parks and wildlife preserves along the canal. To test whether the quality of the water changes from the beginning of the canal to the end, several factors were measured. Water samples were taken from 6 sites along the canal, two sites at the river upstream from the canal, and two sites at the river downstream from the canal, including a site just downstream from where the canal enters the river. Habitat, invertebrates, depth measurements, air and water temperatures, dissolved oxygen, pH, conductivity, turbidity, flow rate, zooplankton and phytoplankton were measured at each site. The tests were repeated at each site three times on different dates. The data was then compared statistically using ANOVA with an alpha value of 0.05 and Tukey's method of multiple comparisons to find potential variation between sites. Although there was not significant variation among sites for stream quality, there did seem to be a rising trend where the river downstream had higher quality compared to the canal. The results reject my hypothesis that the water would be higher quality in the canal than the river.

Board 12 DEVELOPING A MICROSENSOR ARRAY FOR THE MONITORING OF GLUCOSE AND KETONE LEVELS IN DIABETICS. Kristin Butler, 821 Nela View Rd. Cleveland Heights OH 44112 (Hathaway Brown School).
This research focused on the development of an array of micro sensors to aid diabetics in caring for themselves. For diabetic management it is desirable to monitor both blood glucose and ketone levels. The first phase of the project involves the fabrication and testing of a cost-effective, accurate glucose sensor, followed by a ketone sensor in the second phase, and concluded by an insulin infusion system in the third phase. The glucose sensor was fabricated using thick film printing technology. The sensor was designed using AutoCAD and was printed onto an alumina substrate by the silk-screening method. The sensor contained three electrodes: an anode, a cathode, and a reference electrode. Both anode and cathode were platinum, and the reference electrode was silver-silver chloride. Glucose oxidase was immobilized onto the surface of the sensor using protein cross-linking with glutaraldehyde. This enzyme catalyst sensor measures glucose by detecting the amount of hydrogen peroxide produced in the following reaction: Glucose Oxidase $C_6H_{12}O_6 + O_2 \rightarrow C_5H_{11}O_5COOH + H_2O_2$. Testing of the sensor has been conducted at five concentrations: 50 mg/dl, 100 mg/dl, 150 mg/dl, 200 mg/dl, and 250 mg/dl. The collected data was analyzed on a trendline, and correlation coefficients for sensors tested at both three point and a five concentrations have been between 0.9 and 1. These results would indicate that the existing methods of detecting glucose do work. Further analysis of the results reveals an ideal sensor design, and more comprehensive testing to determine how temperature, calibration, and organic substances known to be in blood affect the sensor's accuracy.

Board 13 TO RISE OR NOT TO RISE: YEAST IS THE ANSWER. Natalia D. Haftkowycz, UkieNat@aol.com 4450 Perry Circle, Seven Hills OH 44131 (Incarnate Word Academy).
The purpose of this project was to find out whether changing or varying the amounts of the ingredients in a particular recipe for a loaf of babka (Ukrainian bread) will affect the rise, taste and appearance of the ultimate finished product. This experiment involved baking eighteen different loaves of bread including a control bread and variables including: 3x salt, no salt, hot milk (130° F), cold milk (35° F), 2x yeast, 50% yeast, no sugar, 2x sugar, addition of 1 tsp. baking powder, addition of 3 tsp. baking powder, distilled water, tap water, incubated yeast, frozen yeast, expired yeast, 50% more flour, and baking at 325° F. Each loaf was baked for 55 minutes in an oven preheated to 350° F. Largest hole size in the bread, yeast fermentation time, growth of yeast (bread) in the oven, and color of the bread were measured and recorded for each variable. The baked bread was taste-tested by five observers. Every ingredient affected the finished product in one-way or another. The greatest rise occurred when no salt and expired yeast were used, and the least rise occurred when tap water and 325° F temperature were used. The best tasting bread was the control, and the worst tasting were when triple salt and cold milk were used. The darkest breads were produced when triple salt and cold milk were used, and the lightest breads when 50% yeast, 325° F temperature and baking powder were used. Fermentation time was shortest when hot milk was used, and longest when cold milk was used.

Board 15 IS THAT HAMBURGER YOU'RE EATING *E. COLI* FREE? Peter A. Haftkowycz, Rajkoff@aol.com 4450 Perry Circle, Seven Hills OH 44131 (Incarnate Word Academy).
The purpose of this project was to find out if harmful *E. Coli* (Type 0157:H7) can be found in local hamburger meat and to see if leaving meat in the refrigerator or out on the counter will cause more bacteria to grow, and to see at what temperature it is safe to assume that the meat is safe from the growth of *E. Coli* and other bacteria. The hypotheses included: *E. Coli* (Type 0157-H7) would be found in local hamburger; the meat that is left out the longest will have the most *E. Coli* and bacteria; and the meat that is thoroughly cooked will have the least amount of bacteria. Meat was cultured onto tripticase soy agar and MacConkey agar plates, which were incubated. There were three different tests for the three different sources of hamburger meat (i.e. Tops, Giant Eagle, and Thayer's Meats in Cleveland Ohio in December 2000): refrigerator test, counter test, and cooking test. 22 MacConkey plates were tested for the presence of *E. Coli* using special API strips that were incubated. No *E. Coli* (Type 0157-H7) was found in local hamburger meat Hamburger meat left out the longest either on the counter or in the refrigerator had the most bacteria. And it is safe to assume that the meat is *E. Coli* free at about 120 degrees Fahrenheit (i.e cooked to medium).

Board 16 LEVELS OF NITRATE IN COMMERCIAL BRAND AND HOMEMADE BABY FOOD Christine A. Lewis, 03Clewis@beaumontschool.org 7451 Briar Hill Drive Kirtland OH 44094 (Beaumont School).
High levels of nitrates may be harmful to infants, especially those less than six months old. Infants' stomachs, because of their lower acidity, convert more nitrates to nitrites than an adult's stomach. High levels of nitrates and nitrites may result in difficulty breathing, dizziness, headaches, nausea and vomiting. The purpose of this project was to determine whether homemade baby food or Gerber baby food contain a higher amount of nitrate-N and nitrate. The vegetables and fruits used in homemade baby food are not as closely regulated as commercial baby foods, and therefore homemade baby food may contain a higher amount of nitrates than Gerber baby food. Nitrate-N and nitrate parts per million (ppm) were determined using a spectrophotometer and a standard curve for nitrates in four types of Gerber and homemade baby food. Results showed Gerber to be more consistent in nitrate ppm between the four trials. Homemade baby food varied in amount of nitrates, sometimes lower than Gerber baby foods and sometimes higher. For both types of baby food, green beans showed the highest levels of nitrates and apple sauce the lowest level of nitrates. The findings of this project suggest that parents should be cautioned when feeding homemade baby foods to infants less than six months of age as the levels of nitrates may vary depending on the produce used.

Board 17 THE POWER OF UV LIGHT. Kelly D. Knapp, chica4286@aol.com 7478 Greenfield Trail, Chesterland OH 44026 (Beaumont School).
In this experiment, *Serratia marcescens* was tested against UV light to find out how UV light affects *S. marcescens*. To find out the answer to the question, "Will it be mutated, making it susceptible to antibiotics, or will it be killed?" To do this experiment, the bacteria was exposed to UV light at different intervals of time. The intervals were 0 hr., 2.5 min., 5 min., 7.5 min., 10 min., 12 min., 15 min., 30 min., 1 hr., 2 hr., 4 hr., 6 hr., and 8 hr. The UV light used was part of a hood in a lab. The different intervals were the changing variable. Then the plates were incubated overnight to enhance the bacterial growth. The next day, the surviving bacterial colonies were inoculated into the MIC (Minimal Inhibition Concentration) trays. Those were then incubated overnight. The next day, the results were read using a magnifying mirror reader. This experiment was done twice to ensure the results. It was thought that the UV light would basically kill the *S. marcescens* and make the surviving colonies more susceptible to antibiotics. This was expected from the background research done on how UV light affects DNA. The UV light did kill most of the *S. marcescens* but mutated the surviving colonies making them more resistant to the antibiotics. This is most likely a mutation because of the pigment change and changes in susceptibility seen in the *S. marcescens* after their exposure to the UV light. It turned them a cream color from their original red pigment. This supports Darwin's theory of survival of the fittest. The colonies that survived became more resistant, therefore, would have a longer survival rate.

Board 18 MICROMACHINED NANOMEMBRANES FOR ARTIFICIAL PANCREAS AND KIDNEY. Elena Udovina, lena_u_1999@yahoo.com (Shuvo Roy, roys@bme.ri.ccf.org) Hathaway Brown School, 19600 North Park Boulevard, Shaker Heights OH 44122.
In the technology of BioMEMS (Biological Microelectromechanical Systems), there exists a need for the development of an artificial membrane for use in many applications within the human body. The goal of this research is to advance the development of such a membrane using a unique technology that allows for creation of pores tens of nanometers wide, as opposed to the standard several microns. In this case, the membrane is intended to be used as a semi-permeable encapsulating vehicle for pancreatic cells to be carried throughout the body for the treatment of diabetes or in the dialysis tubing used in artificial kidney systems. Based on prior research and

modern materials literature, polysilicon was selected as the material to be used for the membrane. This research investigates the permeability and transport properties of polysilicon in order to evaluate its use as an artificial membrane. The testing device used is an "ussing chamber" in which the membrane is placed and tested for permeability and other properties. Prior successful results using carbon dioxide as the transport medium were obtained: at pressures ranging from 0.42psi to 0.66psi, the flow rate of carbon dioxide was reported to exponentially increase directly with pressure and to range from 0.60ul/min at 0.42psi to 9.50ul/min at 0.66psi. Current testing is investigating liquid flow across the membrane. The results obtained thus far indicate that polysilicon is a viable potential candidate to be used in a BioMEMS artificial membrane.

Board 19 EFFECT OF STICK TWIST ON THE VELOCITY OF A HOCKEY SLAP SHOT. William C. Musat, Rider3516@aol.com 3516 Darlington NW, Canton OH 44708 (Glenoak High School).
A hockey slap shot consists of a long, fast swing and hitting the playing surface behind the puck, which makes the stick flex and un-flex into the puck, which gives the puck additional velocity. This study was conducted to see if the addition of twist to the stick bend can increase the velocity of the hockey slap shot. It was believed that the combination of bending and twisting of the stick would increase puck velocity. In order to achieve twist in the stick, the toe of the blade on the stick must strike the ground first. This result is a simultaneous bending and twisting of the stick. Using a gravity-powered machine to consistently shoot the slap shots, there were several different types of tests run. There were over one thousand tests run with just the stick bend including seven puck positions and six stick paths. Tests with only the stick bend varied puck position, stick path, stick weight, and stick flexibility. The over one hundred tests with stick bend and twist varied six puck positions and six stick paths. Adding the stick twist caused an increase in puck velocity of 19% (42 KPH to 50 KPH) compared to a swing without the twist. Maximum puck velocity occurred when the puck was placed 175mm behind the axis of rotation, and the stick hit the ground 325mm behind the axis of rotation. This is 225mm further than when no attempt is made to utilize stick twist. Field tests with out the machine showed that the authors' maximum puck velocity went up 15%; from 60 KPH to 69 KPH when the swing was changed to maximize stick twist. It was concluded that stick twist can increase the puck velocity if the swing is modified to have the toe of the blade hit the ground first, and the ground must be hit further behind the axis of rotation than would be done otherwise.

Board 20 WINTER HYDROLOGY OF CLOUGH CREEK: DO THE AQUEOUS SOURCES DIFFER? A COMPARISON OF CREEK WATER, RUNOFF, ICE AND SNOW. Jill E. Neagle, jillneagle@fuse.net 6711 Linder Lane, Cincinnati OH 45244 (Turpin High School).
Do the winter aqueous sources of a creek have similar water quality characteristics to each other? The initial hypothesis stated that creek water, runoff, ice, and snow from Clough Creek, Hamilton County, Ohio would yield similar water quality results. Eight measurable water characteristics were taken from two sites on the Clough Creek three different times, each a week apart in January of 2001. Test kits were used to test the collected water for pH, hardness, carbon dioxide, nitrite-nitrate nitrogen, dissolved oxygen, chlorine, and acidity. These tests are considered standard water quality measurements. The results from the three samples taken were averaged together into Site A and Site B results. The results were graphed by specific characteristics tested at each source site. The graphs indicated significant measurable differences from the same test. For example, the pH of the creek water was 7.7 while the snow was only 6.5. The hardness of the runoff was 22 gpg while the hardness of the ice was 8 gpg. There was also a difference between Site A and Site B in nitrite concentration as Site A was .22 ppm while in Site B it was only .05 ppm. Each source tested came from a different place. The ice had a low hardness concentration because the minerals or hardness are found in the rocks and on the bottom of the creek and the ice sample taken was at the top of the water away from hardness sources. In site A there was more runoff causing the nitrite concentration to be higher. These results supported the conclusion that the winter sources of Clough Creek do differ from one another consequently not supporting the original hypothesis

Board 21 THE EFFECT OF SIDE DOMINANCE ON THE VISUO-SPATIAL FUNCTION OF THE BRAIN: Tasha D. Manoranjan, tasha@columbus.rr.com 2240 Sedgwick Dr., Columbus OH 43220 (Upper Arlington High School).
The purpose of this research project was to determine whether right brain functions were more developed in left-handed people, more specifically, whether there was a correlation between handedness and visuo-spatialness. Visuo-spatialness is a right-brain function, and is described as how someone interprets their environment, and one's ability to see the "bigger picture." This ability describes how someone perceives their surroundings and how well they can focus on more than one object at a time. The visuo-spatial ability of 31 high school students was judged by their performance on four tasks, after determining the side-dominance of each student. The tasks included a pencil and paper maze, constructing a surgeon's knot, creating a star, and a memory test (subjects were shown 8 objects for 15 seconds and were then asked to recite the objects). Findings from this study suggest that side-dominance has no affect on visuo-spatial tasks. When the statistical analysis (which involved using a T-Test and a Chi Squared Test with the data) was completed with the data, the researcher found that any correlation between handedness and visuo-spatialness was too small to be considered significant (0.79, 0.64, 0.23, 0.036), and was due only to chance. This discovery is important because it supports the theory that left-handed people are not stronger in performing right-brain dominated functions. This research project also provides reason that left-handed persons are not right-brained.

Board 22 THE PERFECT WAVE. Andrew J. Loza, ajloza@columbus.rr.com 6337 Manteo Dr., Dublin OH 43016 (Karrer Middle School).
People often wonder why ocean waves break on shore and why some waves are more spectacular than others. The goal of this project was to identify factors affecting wave height. A 4-foot wave tank was built to simulate production of ocean waves. The wave tank was made using Plexiglas and an erector set. A paper grid was attached to the side of the tank to aid in the measurement of wave height (amplitude). A plastic paddle, moved manually at a constant speed, was used to generate the waves. The wave motion was recorded using a video camera and the tape played back at slow speed to facilitate the measurement of wave height. The resulting wave-height data were analyzed using a spreadsheet. An average of ten waves was used to generate each data point. Four variables were examined: distance traveled by the paddle, frequency of wave generation, distance from the paddle that the measurement was made and the presence/absence of a barrier simulating the slope of a beach. The distance that the paddle was moved appeared to have the largest affect on the amplitude of the waves. On average, a 51% increase in amplitude was observed when the distance the paddle was moved increased from one to five inches. The short length of the tank led to significant wave reflection and constructive/destructive interference. In all eight tests waves lost amplitude as they traveled away from the paddle. The presence of a barrier (shore) caused the waves to break reducing their amplitude. The results of these experiments could be applied to the problem of beach erosion caused by very large waves. Future projects would test structures capable of preventing large waves from hitting the shore. Since interference and resistance on the bottom of a wave play a large role in the wave height, one could find a way to cancel out or decrease the energy waves have and thus reduce erosion.

POSTER SESSION
BIOLOGICAL
3:00 – 4:00 PM
KERNS CHAPEL

Board 1 EFFECTS OF STREAM SIZE AND WATER WITHDRAWAL ON *NERITINA GRANOSA* (SAY) SPAT DISPERSION AND MIGRATION IN IAO STREAM, MAUI, HAWAII. Kathleen R. Jennings[1], jenninkr@notes.udayton.edu Timothy M. Fernandes[1], fernantm@notes.udayton.edu Joseph Boreman[2], GreenBeret52@aol.com Austin Hanlin[2], austin_2000_14@yahoo.com Christopher Mikelatis[2], bonjour@wesleyan.edu Annie Mountcastle[2], EinnaM1@aol.com Mary Rider[2], prosthetic_monkey@hotmail.com Chelsea Stengel[2], Chelsers@aol.com M. Eric Benbow[3], benbow@msu.edu Mollie D. McIntosh[3], mdaymc@hotmail.com Albert J. Burky[1], burky@udayton.edu [1]University of Dayton, Dayton OH 45469-2320; [2]JASON Foundation, P.O. Box 587, Needham Heights MA 02494-0005; [3]Dept of Entomology, Michigan State University, East Lancing MI 48824-1115.
An amphidromous limpet, *Neritina granosa*, endemic to Hawaii has a migration pattern hypothesized to be related to water availability and stream flow. Stream diversions prevent upstream migration from ocean to adult freshwater habitats. This capture-release-recapture study measures dispersion patterns and migration of spat (juveniles) from three sites in Iao Stream watershed. Spat from a populated stream were tagged and released upstream and downstream of a diversion in Iao Stream, and into an upstream tributary (Kinihapai Stream). This stream system is normally void of naturally occurring *N. granosa* due to the diversion. Discharges at Iao sites downstream, upstream, and Kinihapai were 0.22±0.01, 2.39±0.17 and 1.96 m^3s^{-1}, respectively. Initial dispersion revealed a higher proportion of downstream movement at the Iao downstream site (41%), with little or no downstream movement at the upstream sites (0-5%). There was an effect of site on mean migratory rate with Kinihapai group significantly faster (1.14 md^{-1}) than Iao upstream (0.67 md^{-1}) and downstream (0.38 md^{-1}). We further found a significant effect of time (3, 5, 6 d post-release) between the Iao sites; however, after taking into account variation due to site, migration rates were only significantly different between day-3 (0.06 md^{-1}) and day-5 (0.63 md^{-1}) post-release in the downstream group. There was an effect of time in Kinihapai Stream with significantly fastest migration one-day post release and declining from 2-4 days as spat dispersed, indicating effects of density on initial migration. Results indicate that reduced stream flow has a significantly negative impact on spat dispersion and migration downstream of diversions.

Board 2 MICROSATELLITE ANALYSIS OF THE TEAYS RIVER CRAYFISH, *CAMBARUS SCIOTENSIS*. Wayne D. Rossiter, cadesecter@hotmail.com (Michael A.

Hoggarth. mhoggarth@otterbein.edu Simon K. Lawrance. slawrance@otterbein.edu). Dept of Life and Earth Sciences, Otterbein College, Westerville, OH 43081-1468.
The recent application of microsatellites to population studies has been successful in examining allelic diversity in isolated populations. The objective of this study is to investigate *Cambarus sciotensis* populations across their geographic range in terms of allelic variation, population dispersal, lineage, breeding patterns, and genetic type locality by isolating microsatellite markers AP-2f and AP-2b. Because *C. sciotensis* exists in small, isolated populations, and because these populations have been in decline, such information will be important to any future conservation effort. We have isolated DNA by using Qiagen DNA Extraction Kits® and simple tandem repeat sequences will be amplified using primers AP-2f and AP-2b in PCR reactions. Products will be examined in terms of numbers of repeats (size), and phylogenetically analyzed using Mac Vector or PAUP programs. We expect limited variation within a population because the species maintains small, locally isolated populations in streams. In addition, we expect a larger degree of variation among populations due to the absence of outbreeding. However, a competing hypothesis would be a limitation of genetic variation based on the specific adaptation of this cray fish to large boulders in riffle habitats within the streams where they occur.

Board 3 ASSESSING THE POTENTIAL IMPACTS OF COASTAL DEVELOPMENT ON GRASS SHRIMP, *PALAEMONETES PUGIO*. Ann E. Hornbrook, s02.ahornbrook@wittenberg.edu Kathleen A. Reinsel, kreinsel@wittenberg.edu, Wittenberg University Box 1456, PO Box 6100 Springfield OH 45501.
The grass shrimp, *Palaemonetes pugio,* is a common decapod crustacean that inhabits estuaries and marshes along the Atlantic and Gulf coasts of North America. They can comprise over half of the macrofauna in these areas and are essential in the transfer of energy in their environment; they increase the rate of detrital breakdown and are food for juvenile fish and crabs. Human impacts potentially affect grass shrimp, thus affecting the stable food source they provide. It was hypothesized that different land uses could affect the development and reproduction of grass shrimp. Fifty grass shrimp were collected weekly from late May through August at each of three sites near Beaufort, North Carolina: Bell's Creek, undeveloped land; Eastman Creek tributary 1, residential land; and Eastman Creek tributary 2, industrial/commercial land. Salinity and pH were measured in the field. Size, sex, gravid state, ovary development, embryo stage and presence of parasites were recorded for each shrimp. Embryos were counted from three females from each site. Salinity (4-26 ppt) and pH (7.3-8.5) did not vary between the three sites. Female grass shrimp were larger than males but mean size of both sexes did not vary between sites. Shrimp had equal parasite loads at the three sites, and parasite loads increased late in the summer. Reproductive condition, measured by gravidity and developing ovaries, did not differ between sites, but biweekly reproductive cycles were apparent at the beginning of the season. These results do not indicate a measurable effect of these different land use patterns.

Board 4 A NEW SUBFOSSIL FISH SITE FROM THE SANDUSKY BAY AREA OF LAKE ERIE. Ted M. Cavender, cavender.1@osu.edu Museum of Biological Diversity, 1315 Kinnear Rd, Columbus OH 43212-1192.
Individual disarticulated fish bones from the Ensign Archaeological Site (33SA93) were analyzed qualitatively and quantitatively in order to learn more about the native fishery. The material represents a Sandusky Bay fauna excavated from a late Woodland (1450) Village site located in Sandusky County northeast of Clyde just a few miles from the present Sandusky Bay shoreline. Dr. Jonathan Bowen, Ohio Historical Society, directed the excavation in 1999 and 2000. David Davies, ODNR-DOW Sandusky, supervised much of the sorting of fish remains. Fish were found in 181 collections, representing a full stratigraphic range for village occupation. Species identification and minimum number of individuals (MNI) for each species were determined for the 181 collections. A total of 1401 individuals were identified representing 26 species. Most individuals were divided among 20 species: bowfin, white sucker, silver, river and golden redhorses, yellow and brown bullheads, channel catfish, northern pike, white bass, rockbass, smallmouth and largemouth bass, bluegill, pumpkinseed, yellow perch, walleye, and freshwater drum. Walleye was the most abundant fish recovered (30% of the total individual fish recovered). Walleye, drum, pumpkinseed, rockbass, whitebass and bullhead amounted to 70% of the total utilized for food. A majority of walleye were in the 350-400mm standard length size range. Only an occasional walleye was of large size 500mm SL. The cisco was found in small numbers. Historical records show this species entered Sandusky Bay in the fall season (November). The presence of spring migrants such as walleye plus summer spawners like pumpkinseed, and cold water migrants such as cisco suggest villagers fished the bay throughout the open water period (spring through fall).

Board 5 SURVEY OF THE SALAMANDER FAUNA OF TWO TRIBUTARIES OF SILVER CREEK AT THE J.H. BARROW FIELD STATION. Christopher A. Distel, Distelca@hiram.edu and Samuel D. Marshall, J.H. Barrow Field Station, Dept of Biology, Hiram College, Hiram OH 44234.
Salamanders are an excellent indicator taxon for ecosystem health because of their sensitivity to water quality. To initiate a long-term population survey we surveyed potential refuge sites along two tributaries of Silver Creek at the J. H. Barrow Field Station in Hiram Township, Portage County. Each tributary was evaluated for salamander population diversity and density using the quadrant method on two different dates (15 & 23 Sept. 2001). A 1m x 1m square plot was sampled every 10 meters for 100 meters, heading upstream from Silver Creek. Three 100m transects were tested, two of them along the same tributary. Some of the plots contained running water and some were dry at the time of the survey. All moveable rocks completely or partially inside the quadrant were lifted to observe salamander presence. Adult and juvenile salamanders of the following species in the following quantities were found: 13 *Eurycea bislineata*, 21 *Desmognathus fuscus*, 24 *Desmognathus ochrophaeus*, and 8 *Plethodon cinereus*. No visible upstream-downstream gradient in species presence or density was found.

Board 6 SITE FIDELITY IN WOOD TURTLES (*CLEMMYS INSCULPTA*) IN NORTHERN MICHIGAN. Erin Zayicek[1], s03.ezayicek@wittenberg.edu Timothy L. Lewis[1], Phillip Huber[2], [1]Wittenberg University Dept of Biology, Springfield OH 45504, [2]United States Dept of Agriculture, Forest Service, Mio Ranger District, Mio, MI.
Wood turtles (*Clemmys insculpta*) grow to a carapace length of 20 cm, weigh 800 g, and live in semi-aquatic environments in the northeastern and northern Midwest area of the United States and adjacent portions of southern Canada. Human impacts, such as habitat destruction and removal of animals for pets, pose significant threats to this species. Fidelity to a specific location, as opposed to habitat type, would put this turtle at risk in areas where such habitat changes are occurring. We used radio telemetry and mark and recapture techniques with 73 wood turtles found during the summers of 1998 through 2001 along Michigan's Au Sable River in the Huron National Forest. The river corridor had a sandy soil substrate containing mostly jack pine (30.0%) and red pine (19.3%), as well as some aspen (9.2%), wetland conifers (13.4%), and some other deciduous trees. The river channel itself constitutes just 2.7% of the protected corridor. This forest is managed for recreational and other public use, with the river corridor supporting thousands of canoeists and anglers. Of turtles found, 6 turtles were recaptured in multiple years. All showed overlapping home ranges between years, indicating annual site fidelity ($P<0.01$). Because turtles return to or remain in the same locations year to year, it may indicate higher levels of site fidelity. Therefore, it may be important not only to protect habitat types but also specific locations.

Board 7 LITHIUM UPTAKE INTO THE FIDDLER CRAB *UCA PUGILATOR*. Christopher M. Gillen, Gillenc@kenyon.edu Anne Mayer, Mayera@kenyon.edu Dept of Biology, Kenyon College, Gambier OH 43022.
The fiddler crab, *Uca pugilator*, osmoregulates in dilute seawater, maintaining hemolymph osmolality above external osmolality. Active uptake of sodium plays a major role in this osmoregulation. In this study, we tested whether lithium uptake can be used as a tracer for whole body Na transport in *Uca pugilator*. Next, we tested the hypothesis that lithium uptake is increased in *Uca pugilator* acclimated to dilute seawater. Lithium uptake was measured in artificial seawater (ASW) solutions with Na replaced with the impermeant cation choline and lithium (100% ASW assay solution: 9.4 mM KCl, 9.0 mM $CaCl_2$, 22.1 mM $MgCl_2$, 25.6 mM $MgSO_4$, 5.4 mM $KHCO_3$, 4.2 mM LiCl, and 420.8 mM choline chloride). Hemolymph was sampled after timed exposure, diluted 1:100 in water, and cation exchange chromatography was used to measure hemolymph cations. A time course of lithium uptake was linear for 40 minutes. Lithium uptake was measured in 20%, 50%, and 100% ASW solutions. As expected, lithium uptake was decreased in dilute ASW. Crabs were acclimated for 3 weeks to 100% or 20% seawater and assayed for lithium uptake in 20% ASW solutions. Lithium uptake was 0.87 ± 0.28 $\mu mol\ g^{-1}\ h^{-1}$ (N=6) in 20% acclimated crabs and 0.74 ± 0.17 $\mu mol\ g^{-1}\ h^{-1}$ (N=6) in 100% acclimated crabs. In contrast to expectations, lithium uptake was not greater in crabs acclimated to dilute seawater. Thus, although we can accurately quantify lithium uptake in *Uca pugilator,* lithium may not be a good tracer for active sodium uptake.

Board 9 SURVEY OF AMPHIBIANS AT BIG ISLAND WILDLIFE AREA, MARION COUNTY, OHIO. Thomas P. Archdeacon, t-archdeacon@onu.edu Ohio Northern University, Ada OH 45810.
Amphibians in Big Island Wildlife Area (Big Island Township, Marion County, Ohio) were surveyed using screen funnel trapping, search and seize, and vocalization surveys. The survey lasted 25 man-hours from 14 February to 21 May 2001. Three woodland pools and two fields were surveyed. Eight species of frogs (Order Anura) were detected; last known voucher is in parentheses. *Bufo americanus*, three captured, detected at all bodies of water surveyed (1999). *Pseudacris triseriata*, three captured, detected at all bodies of water surveyed (1999). *Acris crepitans*, detected at one location (Marion County 1964). *Hyla versicolor/chrysoscelis*, detected at three pools (Marion County 1999). *Pseudacris crucifer*, one captured, detected at three pools. *Rana pipiens*, four specimens collected, detected at all terrestrial and aquatic areas surveyed (1999). *Rana clamitans* and *Rana catesbiana*, one specimen of each was captured, both species were observed at all bodies of water surveyed. Two other species may be present because the wildlife area lies within the normal range of both species. Calling surveys may not have detected the presence of either species. One species of salamander (Order Caudata) was found, *Ambystoma texanum*. Thirty-five individuals were collected during the study. Two species were previously reported

for the township, *Ambystoma texanum* (post 1950) and *Ambystoma tigrinum* (before 1950). The absence of *Ambystoma tigrinum* and other ambystomatid salamanders may be attributed to agricultural practices that have destroyed higher quality habitat needed for breeding.

Board 10 MUSCLE FUNCTION IN THE DUSKY SALAMANDER (*DESMOGNATHUS FUSCUS*): AN ANALYSIS OF METABOLIC ENZYME ACTIVITIES, LDH ISOZYME COMPOSITION, AND RECOVERY FROM EXERCISE. Elizabeth A. Russ, **RUSSEA@muc.edu** (Brandon Sheafor, **sheafobr@muc.edu**) Mount Union College, Box 1950, 1972 Clark Ave., Alliance OH 44601.
Dusky salamanders (*Desmognathus fuscus*), lack lungs and perform all gas exchange across their skin. Because they rely solely on cutaneous respiration, it is likely that their intake of oxygen is compromised and that diffusion of gasses is impaired due to the need for skin to serve also as an external barrier. It is not clear if dusky salamanders reduce ATP use, modify metabolic pathways, or rely on fermentation pathways in order to compensate for reduced respiratory surface area. For results to carry significance as to the function of lungs and the adjustments made by lungless salamanders, comparisons were made between *Desmognathus fuscus* (n=5), and fire-bellied newts, *Cynops pyrrhugaster* (n=5), a lunged salamander species of similar mass. Citrate synthase (CS) was used as an oxidative marker enzyme and lactate dehydrogenase (LDH) as an anaerobic marker enzyme to determine the oxidative and anaerobic capacity of tissues. Analysis of tissue lactate accumulation and removal during exercise was also performed. Preliminary results show that CS activity in *Desmognathus* heart and liver tissues are twice what is found in *Cynops*. *Desmognathus* skeletal muscles, such as neck and tail tissue, demonstrate LDH levels that are seven and five times greater than *Cynops*, respectively. *Desmognathus* lactate levels approximated resting levels (≈4 mmol/Kg) 25-30 minutes after exercise. Lactate removal in this organism may be facilitated by the composition of LDH isozymes within tissues. Relative amounts of LDH isozymes will be quantified by native gel polyacrylamide electrophoresis to gain a clearer understanding of the mechanisms associated with lactate removal.

Board 11 SOURCE/SINK: THE INFLUENCE OF COMMON SNAPPING TURTLES (*CHELYDRA SERPENTINA*) ON THE POPULATION DENSITY OF JUVENILE EASTERN PAINTED TURTLES (*CHRYSEMYS PICTA PICTA*). Kristen M. Reinhart[1], **kristenr@muskingum.edu** David R. Bowne[2], **drb9d@unix.mail.virginia.edu** [1]Muskingum College, Dept of Biology, New Concord OH 43762 and [2]University of Virginia, Blandy Experimental Farm.
Relatively few studies have defined source/sink habitats based on juvenile survivorship of the species in question. In this study, source/sink habitats for eastern painted turtles were determined by examining the percentage of juveniles in a series of 10 farm ponds. We assumed that ponds with a high percentage of juvenile painted turtles defined a source habitat, while ponds with small numbers of juveniles acted as a population sink. From 12 June through 3 August 2001 we set out to determine the extent to which common snapping turtles influence the numbers of juvenile painted turtles in 10 ponds ranging from 0.054 to 0.604 ha on the Blandy Experimental Farm in Clarke Co., VA. Using sardine baited hoop-net traps, we captured and marked a total of 98 juvenile painted turtles from 5 ponds without snapping turtles and 5 ponds with snapping turtles. A population estimate for the number of juvenile turtles in each pond was determined using Huggins Robust Design. Results from a multiple linear regression analysis revealed a significant negative correlation ($r^2 = 0.756$; $F_{3,6} = 6.2$, $P = 0.03$) between the percentage of juveniles in each pond and snapping turtle biomass. These findings suggest that adult snapping turtles have a potential adverse affect on juvenile painted turtles survivorship and recruitment.

Board 12 USE OF GEOGRAPHIC INFORMATION SYSTEMS IN IDENTIFICATION AND ASSESSMENT OF POTENTIAL SPOTTED TURTLE (*CLEMMYS GUTTATA*) HABITATS IN OHIO. Joseph M. Ullmer, **Ozz11@aol.com** John B. Ritter, **jritter@wittenberg.edu** and (Timothy L. Lewis, **tlewis@wittenberg.edu**) Wittenberg University, Depts. Geology and Biology, Springfield OH 45501.
Populations of spotted turtles (*Clemmys guttata*) have declined over the last two decades throughout its range in eastern North America, largely due to habitat loss, predation, and over-collection. In Ohio, this species was listed as endangered until the late 1980's, but its status was downgraded to "Species of Special Interest," largely due to limited data on population status. Given the significance of habitat loss to this species and the extremely high percentage of wetlands destroyed in Ohio (91% of original wetlands lost), identification of potentially suitable habitat is important for conservation and restoration of wetlands. We are using ArcGIS to classify 50 Ohio habitats based on available data layers, including surficial geology, soils, wetlands, and groundwater pollution potential, digital elevation models, aerial photography, and satellite multi-spectral scanner data. For example, satellite imagery from dry seasons has proven useful in evaluating critical wetland quality previously identified in the wetlands inventory; groundwater pollution potential data indicates vulnerability to nearby development. Ohio's Natural Heritage Database includes 50 locations of reported spotted turtle sightings throughout 21 counties in Ohio since 1958. With these data we will predict potential habitats and evaluate these areas with site visits and comparisons to identified, state-protected wetlands. Use of GIS in identifying critical habitats provides a means of finding, delimiting, and prioritizing areas for conversation and restoration.

Board 13 AVIAN SPECIES DIVERSITY IN TWO RESTORED WETLANDS IN HARDIN COUNTY, OHIO. Scott E. Zink, **s-zink@onu.edu** Ohio Northern University, 402. W. College Ave. Unit 3547, Ada OH 45810.
Avian species diversity of two restored wetlands in Hardin County, Ohio and three habitats within those wetlands were studied for one year. Wetland 1 (17 hectares) contained open water, marsh, and prairie habitats; Wetland 2 (19 hectares) had a smaller body of water, more marsh, and similar prairie coverage. Beginning in September of 2000 a walking transect was used to sample the study sites every fourteen days until September 2001. A chi-square test was performed to determine if significant species diversity differences existed. A Jaccard analysis was run to test similarity of species at the two sites. The Simpson species diversity index was calculated to compare species diversity between the study sites and among the three habitats. The chi-square test indicated that Wetland 1 (sixty-two species) had greater species diversity than Wetland 2 (forty-eight species). The Jaccard analysis showed a forty-one percent similarity of species. The Simpson index for species diversity indicated that Wetland 1 supported greater species diversity. All of these differences may be a result of the different size and habitat mixture of the wetlands studied. In addition, Wetland 1 was more secluded than Wetland 2, and was not subject to road noise and other human influence. The Simpson index for habitat species diversity indicated that prairie habitat supported the greatest species diversity; followed by marshy area, then open water. This was probably due to the greater area covered by the prairie, and greater spatial heterogeneity in both the prairie and marshy habitats. Both wetlands provided habitat for uncommon resident and migratory species. The study shows that small patches of restored wetland make an important contribution to local and migratory avian species.

Board 14 BREEDING BIRD DIVERSITY IN SOUTHEASTERN IDAHO. John J. Kuenzli[1], **j-kuenzli@onu.edu** and Joel Sauder[2], **saudjoel@isu.edu** [1]Ohio Northern University, 402 W. College Ave. Unit 1510, Ada OH 45810 and [2]Idaho State University, Dept of Biological Sciences, Pocatello ID 83209.
A survey of birds was conducted during the months of June and July 2000 and 2001 in three habitats in Oneida County, southeastern Idaho. The goal of the study was to compare the diversity of bird species found among the three habitats. The three habitats were sage-steppe, juniper woodland, and aspen groves. Six plots were set up in each habitat type. Each plot was sampled a total of eight times (four times in 2000, four times in 2001), at intervals of at least ten days. Ten mist nets were placed in each plot for a period of five hours beginning at sunrise. Aspen groves contained the most birds (36 species, 1015 individuals banded), followed by sage-steppe (27 species, 857 individuals banded) and juniper woodland (23 species, 456 individuals banded). The differences in avian diversity were probably due to the plant variety and richness, offering greater foraging opportunities, more nesting sites and materials, and more shelter.

Board 15 TEMPORAL PATTERNS OF KIRTLAND'S WARBLER (*DENDROICA KIRTLANDII*) OCCUPANCY OF JACK PINE (*PINUS BANKSIANA*) IN THE HURON NATIONAL FOREST, NORTHERN LOWER MICHIGAN. Christopher T. Hemmig[1], **s02.chemmig@wittenberg.edu** Philip W. Huber[2], Timothy L. Lewis[1], [1]Wittenberg University Dept of Biology, Springfield OH 45501, [2]Wildlife Biologist, Mio Ranger District of Huron National Forest, 401 N. Court St, Mio MI 48647.
Kirtland's warbler (*Dendroica kirtlandii*), an endangered songbird habitat specialist, breeds only in large areas of young jack pine (*Pinus banksiana*) with heights of $1.4 \leq x \leq 5.2$ m, located primarily in a few counties of northern Lower Michigan near Grayling. Currently, there are only about 1,000 breeding pairs for the entire species. Recent findings have provided insight into the factors most affecting jack pine growth in this region (climate and soil), the spatial distribution of these factors, and the relation between these factors and patterns of Kirtland's warbler occupancy in a given area. In this study, data from annual June censuses from 1986-2001 of the Kirtland's warbler were examined at the level of individual stands of jack pine within the US Forest Service Management Areas (MA) of the Huron National Forest in northern Lower Michigan that have been used by the warblers, but are no longer occupied. In comparisons between 5 MAs, stands within Big Creek MA and Eldorado MA tended to be occupied longest with averages of 7.8 years (S.D. = 2.8 years) and 7.5 years (S.D. = 1.9 years), respectively. This seems to reflect how the nutrient-poor, sandy soils and the relatively extreme microclimate in these areas slow the rate of jack pine growth, increasing the amount of time that stands in these areas are suitable for Kirtland's warbler breeding habitat.

Board 16 STUDIES TO DOCUMENT TEMPERATURE AND LIGHT EFFECTS ON ANTHOCYANIN ACCUMULATION IN LETTUCE (*LACTUCA SATIVA*). Darla G. French, **frenchdg@acs.wooster.edu** (Matthew Kleinhenz, **kleinhenz.1@osu.edu** and William Morgan, **wmorgan@acs.wooster.edu**) College of Wooster, Box 1588, 1189 Beall Ave, Wooster OH 44691.
Anthocyanins are a large class of water-soluble pigments found in nearly all vascular plant tissues. Biosynthesis and regulation of anthocyanins at the molecular level are well characterized; less well known is their accumulation in response to environmental

factors. Important in photosynthesis, they are thought to accumulate in response to abiotic environmental stresses, including intense light or low temperatures. A more complete characterization of these protective responses would have scientific and practical benefits, especially for the lettuce industry, which requires vividly colored products. Using cultivated lettuce (*Lactuca sativa*) as a model system, the primary objective of this study is to determine the independent and interactive effects of temperature and light levels on anthocyanin levels. A related objective is to develop a rapid, reliable method for quantifying anthocyanin levels in plant tissue spectrophotometrically. A total of 432 plants from four varieties of *L. sativa* genetically predisposed to vary in anthocyanin production were exposed to differential light intensity and temperature treatments for 5 weeks in an environmentally controlled greenhouse at OSU/OARDC in Wooster, OH. The first fully expanded leaf was removed from each plant at three developmental stages and sub-sampled. Sub-samples were frozen within 2 hours of removal and stored at –20 C until pigment extraction in HCl-methanol, and subsequent measurement. Anthocyanin levels are expected to be greatest in plants grown under full light and fluctuating temperatures, and lowest in plants grown under reduced light and constant temperature. Absorption spectra from preliminary samples show clean peaks at 420, 540, and 660 nm, accepted as absorption maxima for chlorophyll a, anthocyanin, and chlorophyll b, respectively. After ANOVA statistical tests to compare anthocyanin levels in tissue from each treatment, graphs will be designed to show these comparisons and the possible effects of light and temperature on anthocyanin accumulation.

Board 17 SEASONAL VARIATION IN EPIPHYTIC MICROFLORA OF POLYSTICHUM ACROSTICHOIDES. Ellen M. Giordano, giordaem@muc.edu (Jonathan Scott, scottjj@muc.edu) Mount Union College, 1972 Clark Ave, Alliance OH 44601.

Leaf surfaces provide an excellent environment – a source of water, nutrients, and protection – for the growth and reproduction of epiphytic bacteria, filamentous fungi, and yeast. Much research has been conducted on the epiphytic microflora communities associated with various plant species. While most of these studies have focused on crop plants, some work on non-flowering plants has been done. For example, bacteria associated with mosses have been implicated in playing a role in moss development. However, there is very little information available on microorganisms associated with ferns and their possible role in fern development. Hence, this project aims to investigate the epiphytic microflora diversity of *Polystichum acrostichoides* and to demonstrate that like many other plants, ferns show qualitative and quantitative seasonal variation in diversity of their epiphytic communities. Two naturally growing fern samples will be gathered from the woods of the Mount Union College Nature Center in October and November of 2001 and in January and March of 2002. After removal of casually associated microorganisms by washing in sterile water, their epiphytic microflora will be collected from leaves by brief sonification in sterile water. The sample washings will then be diluted and plated on potato dextrose agar with chloramphenicol (for isolation of filamentous fungi), wort agar with chloramphenicol (for isolation of yeast), and nutrient agar with cycloheximide (for isolation of bacteria). Bacteria identification will be based on Gram reaction, colony characteristics, oxidase and catalase reactions, and oxidation/fermentation tests. Yeast and filamentous fungi will be identified using available taxonomic reference sources. Population densities (as colony-forming units per cm^2) and diversity indices will be determined for each category of microorganism.

Board 18 THE ROLE OF NITROGEN IN SYLLEPTIC BRANCHING IN HYBRID *POPULUS*. Mirunalni Thangavelu, thangavelu.2@osu.edu (Morris G. Cline, cline.5@osu.edu) The Ohio State University, Dept of Plant Biology, 1735 Neil Ave., Columbus OH 43210.

In certain species of *Populus*, some axillary buds grow out in the same season in which they are formed instead of over-wintering and flushing in the spring. This type of branching is referred to as sylleptic branching and may significantly enhance early tree growth. Its primary cause is unknown. Nitrogen has been reported to enhance sylleptic branching but the precise form, method of assimilation and mechanism of action in promoting this lateral bud outgrowth have yet to be determined. The present first trial investigation was carried out to help lay the groundwork for the future elucidation of this role of nitrogen. The effects of different forms of nitrogen (ammonium nitrate, ammonium chloride and potassium nitrate at 5 and 50 mM) on sylleptic branching were analyzed in two hybrid clones (*P. trichocarpa*, black cottonwood x *P. deltoides*, eastern cottonwood) of poplar with contrasting degrees of sylleptic branching (47-174 with a low amount of sylleptic branching and 11-11 with a high amount of sylleptic branching). The nitrogen applications were given to eight-week-old saplings (usually, four to five per treatment) propagated from stem cuttings growing in Pro-mix in gallon pots under greenhouse conditions. The treatments over a three-week period did not promote any sylleptic branching in the low sylleptic clone (47-174) but did significantly enhance sylleptic branching in the high sylleptic clone (11-11) thus suggesting the requirement of other factors in addition to nitrogen for branching. Attempts also will be made to analyze the role of nitrogen in organic forms (e.g., asparagine, glutamine and glutamate) in sylleptic branching.

Board 19 AN ANALYSIS OF SUCCESSION AND REGENERATION IN BEECH-MAPLE FORESTS OF NORTHERN LOWER MICHIGAN. Lucas E. Nave, s02.lnave@wittenberg.edu (Ronald A. deLanglade, rdelanglade@wittenberg.edu Timothy L. Lewis, tlewis@wittenberg.edu) Wittenberg University, Dept of Biology, Springfield OH 45501.

Forests dominated by American beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*) once constituted a large portion of the woodlands covering the Eastern and North Central United States. However, the composition of *Fagus-Acer* forests has been changing remarkably in the time since scientific attention has been focused on forest dynamics, with researchers in different geographical locations reporting different results. This research was initiated to test hypothesis that the composition of *Fagus-Acer* forests in Northern Lower Michigan is changing by examining regenerative values for the two species. Other goals for this research include: establishing baseline data for a new location, comparing results with the results of similar research performed in Southwestern Ohio, and making inferences about the future species composition of *Fagus-Acer* forests. Sampling of study sites was accomplished using a line-plot method to count stems of each species, which were classified according to height classes. Sampling was performed on four woodlots located in the Huron National Forest, in the north-central region of Michigan's Lower Peninsula. The preliminary results of the sampling suggest that *Fagus grandifolia* is currently regenerating at over three times the rate of *Acer saccharum*. With sampling and data collection complete, the remaining objectives of this research are data analysis, to provide frequency, density, dominance, and regeneration values for each species, and the formation of conclusions regarding the current status and future composition of *Fagus-Acer* forests.

Board 20 EFFECTS OF LIGHT EXPOSURE AND TISSUE REMOVAL ON LEAF CHLOROPHYLL CONCENTRATION OF BENT GRASS (*Agrostis stenuis*). Morteza Javadi, mjavadi@cscc.edu Elizabeth A. Adams and Brandy K. Wippel, Columbus State Community College, Biological and Physical Sciences Dept, 550 E. Spring St., Columbus OH 43216.

Inadequate exposure to light and/or frequent leaf trimming may reduce the leaf chlorophyll concentration. Field and laboratory experiments evaluated the effects of light exposure and tissue removal on the leaf chlorophyll concentration of bent grass. The field experiment was conducted at Columbus State Community College Bridgeview Golf Course. The experiment, a split plot design, contained three replications. The levels of light exposure, as exposed (6,000 ftc) versus covered (50 ftc), and the tissue removal, as trimmed versus intact, served as subplot and main plot treatments respectively. Chlorophyll was extracted by Hiscox and Israelstam procedure, and the chlorophyll concentration was determined based on the work of Arnon. No significant difference was observed between exposed-intact and covered-trimmed plants. However, chlorophyll concentration was significantly higher ($P \leq 0.05$) for the two aforementioned treatments, when compared with covered-intact and exposed-trimmed plants.

Board 21 THE EFFECT OF WATER AVAILABILITY ON THE LEVELS OF RUTIN AND CHLOROGENIC ACID IN TOMATO PLANTS. Roy H. Haber Jr., rhaber@bw.edu and Dr. Natalie Barratt, nbarratt@bw.edu Baldwin-Wallace College, 275 Eastland Rd, Berea OH 44017.

Phenolics are a large class of secondary metabolites that allow plants to cope with various environmental stresses such as herbivory and excess light energy. The growth differentiation balance hypothesis (GDB) explains how plants allocate carbon reserves between growth and differentiation (secondary metabolites) when exposed to differing resource levels. According to the GDB, low resource environments will restrict growth and differentiation, intermediate resources will restrict only growth, and high resource environments will restrict differentiation but not growth. It was hypothesized that droughted soil will restrict plant growth, therefore more carbon will be allocated to differentiation and phenolic levels will be higher. Plants were droughted for one, two, and three-week periods while well-watered control plants were also maintained. Droughted plants were maintained at soil moisture level 2-3, and control plants were maintained at level 7-8, as measured with an Instamatic Duo Light Moisture meter. Extracts from leaves of 52 droughted and control tomato leaves were analyzed. Levels of rutin and chlorogenic acid (CGA), the most abundant phenolics in tomato plants, were determined spectrophotometrically. The data show that drought stress does not have a significant on levels of rutin and CGA in tomato plants as indicated by standard error tests. These results did not support the hypothesis and a few reasons may be offered. First, it is known that drought stimulates the production of the plant hormone abscissic acid (ABA), and increased ABA levels can suppress phenolic production. Second, plants were only subjected to low and high levels of water and others suggest that more than two resource levels must be used when evaluating the GDB. More research is needed to obtain a clearer picture of the effect that drought stress has on phenolic levels in plants.

Board 22 ESTIMATING STAND-LEVEL WATER FLUX IN A NORTHERN HARDWOOD ECOSYSTEM. Claudia R. Steele, steele.127@osu.edu Brian D. Bovard, Peter S. Curtis, The Ohio State University, Dept of Evolution, Ecology, and Organismal Biology, 1735 Neil Avenue, Columbus OH 43210-1293.

We are studying climatic effects on whole-tree and ecosystem water use in a deciduous forest at the University of Michigan Biological Station in Pellston, Michigan (45° 35′ N, 84° 42′ W). In this study our main objectives were 1) to quantify variation in

sap flux with sapwood depth in the dominant tree species, and 2) to compare stand-level sap flux with above-canopy measurements of latent heat exchange (LE). Thermal dissipation probes were used to measure sap flux velocities in five tree species: *Acer rubrum* (red maple, n=4), *Betula papyrifera* (paper birch, n=7), *Pinus strobus* (white pine, n=4), *Populus grandidentata* (bigtooth aspen, n=6), and *Quercus rubra* (red oak, n=5). Radial sap flux measurements were taken at 1cm, 2cm, and 3cm depths within the xylem of *A. rubrum*, *B. papyrifera*, and *P. grandidentata*. This study is on going, with results presented here from January through December 2001. We found that all measured tree species responded to environmental conditions with similar trends in sap flux. Stand-level sap flux underestimated ecosystem LE by 21-56%. Analyses of radial sap flux profiles indicated sap flux varied with depth and should be considered when scaling these data to the stand level.

Board 23 EFFECT OF FERTILZER, NURSE CROPS AND SEEDLING DENSITY ON COMPOSITION AND PRODUCTIVITY OF WILDFLOWER MEADOWS USING A COMMERCIAL SEED SOURCE. Michael J. Greiner, greinemj@muc.edu (Dr. Charles McClaugherty mcclauca@muc.edu) Mount Union College, 1972 Clark Avenue, Alliance OH 44601.
The purpose of this study is to find the optimal planting protocol to yield a wildflower meadow with maximum productivity and frequency of target species and minimum frequency of invasive species. The study was located at the John T. Huston-Dr. John D. Brumbaugh Nature Center of Mount Union College, Alliance, Ohio. The study site was cleared using herbicide (Round Up®), mowing and cultivation in late April of 2001. Sixty squares each 2.13 meters on a side were created in the plot. The inside square meter was used for target species analysis, leaving a buffer zone between squares. There were a total of twelve treatments; the squares were sown with fertilizer (27-3-3) or without fertilizer, a clumping nurse grass (*Buchloe dactyloides* Nutt. Engelm.) or no nurse crop and 0x, 1x or 2x seeding, meaning 1x received 6.5g/m^2. All seeds were purchased through the Vermont Wildflower Co. as recommended for seeding. Planting occurred during the first week of June 2001 with fertilizing of the appropriate squares taking place during the middle of July after proper vegetation had become established. A soil sample was collected from each square at the time of planting to calculate moisture and organic content. Samples were also collected at the driest point during the project and analyzed as to moisture content for comparison. After the growing season is complete analysis will begin on the squares, which will consist of vegetation identification on a presence/absence basis. Using ANOVA, plot productivity, maximum frequency of target species and minimum frequency of invasive species will be compared. Expectations are that study squares with a nurse crop, fertilizer and 2x seeding will come closest to achieving the desired community composition and productivity.

Board 24 EFFECTS OF DECIDUOUS FOREST RESTORATION IN SOUTHWESTERN OHIO: SURVIVAL, WOODY RECRUITMENT, AND VEGETATION COMPOSITION FOLLOWING PLANTING DISTURBANCE. Carolyn Keiffer, keiffech@muohio.edu and Cathlene I. Leary, Miami University, Dept of Botany, Oxford OH 45056.
Successful conversion of pastures to forest is often hindered by the lack of structural complexity, which in turn reduces seed dispersal and woody recruitment. A long-term restoration study was initiated on a former pasture at the Fernald Environmental Management Project in southwestern Ohio (Butler County). Our objective was to establish a planting design that has the potential to accelerate the restoration and succession of a site by creating structural complexity with uneven-aged stands of native trees. Eight 0.1 ha plots were established of four treatments, with 2 replicates of each: Control (no planting), Seedlings (120 individuals of 5 species planted), Saplings (200 individuals of 5 species planted), Mixed (120 seedlings, 100 saplings, each of 5 species). One year following the 1999 planting, seedling mortality was high (67.6%-98.5%) primarily due to drought stress, vole damage, and competition from existing vegetation while sapling mortality was low (1.6%-13%), although evidence of deer rubbing was present. At 16 months following planting, woody recruitment was not affected by the planting treatments ($P > 0.05$). Based on principle coordinates analysis (PCO), we found that herbaceous composition differed significantly ($P < 0.0001$) from other planting treatments where high densities of saplings were planted, specifically due to a significant increase in perennial herbs ($P < 0.001$). We attribute this compositional change to increased colonization via wind-dispersal and rhizome exposure of gaps created in the pasture grasses following planting disturbance. The results of this study suggest that disturbances related to restoration planting may dramatically alter the herbaceous vegetation composition of a site.

Board 26 EFFECT OF NUTRIENT AVAILABILITY ON FOOD WEB STRUCTURE IN A SIMPLE MICROCOSM FOOD WEB. Claire E. Steiner, steinece@muohio.edu (Martin Henry H. Stevens), 316 Pearson Hall, Dept of Botany, Miami University, Oxford OH 45056.
Relations between heterotrophic consumers and autotrophic producers are fundamental to all ecosystems, yet remain poorly understood. Laboratory microcosms permit the necessary control over food web structure and the necessary number of generations required to test explicit hypotheses of facilitation and competition between autotrophs and heterotrophs. Laboratory microcosms were used to test hypotheses generated by a simple food web model of bacteria-algae relations. The model consists of four components: a single nutrient (1) that limits both algae (2) and bacteria (3), and ciliate predator (4) that feeds exclusively on bacteria. None of these components is self-limiting (i.e. no intraspecific density dependence), and nutrient availability that depends on the mass balance of the entire system. The microcosm food web used tests this model consists of nutrients and three "trophic species": a bacteria guild, a bacterivore predator guild, and a single inedible alga species. Food web replicates were established in 100ml of nutrient media at standard and one-tenth standard concentrations. Half the replicates were placed in the dark to control for the effects of algae in the food web. Three times a week direct microscopy was used to estimate densities of ciliate bacterivores and algae in each replicate. Once weekly, seven serial dilutions (10^1:10^7) were used on nutrient agar to estimate bacteria abundances. Preliminary results show that the bacterivore predators achieve much greater abundance in the absence of algae. This is consistent with the model's assumption that bacteria and algae compete for nutrients.

Board 27 THE EFFECTS OF ENRICHMENT ON WHITE-CHEEKED GIBBONS AT THE COLUMBUS ZOO AND AQUARIUM. Kelly E. Steurer, ksteurer@muskingum.edu (Danny J. Ingold, ingold@muskingum.edu) Muskingum College, New Concord, OH 43762.
The future success of many primate species may be linked to their ability to survive and reproduce in captivity. One problem observed in captive primates is their propensity to engage in displacement behaviors that sometimes adversely affect their health. Displacement behaviors are abnormal behaviors that occur in captive animals as a result of boredom. Researchers have implemented a variety of behavioral enrichment devices and activities designed to reduce displacement behavior and enhance the rate of natural foraging in captive primates. From May through August 2001, the effects of various behavioral enrichment devices were studied on captive white-cheeked gibbons (*Hylobates leucogenys*) at the Columbus Zoo in Powell, OH. Gibbon behavior was monitored before and after the addition of enrichment devices in order to determine the effectiveness of these devices to alleviate displacement behaviors. The most effective devices to deter adverse behaviors and combat boredom were those that required searching for food; puzzle feeders for instance were ostensibly effective since they necessitated significant thought and effort to retrieve that food. Enrichment attempts without food were not successful. Overall, it was found that enrichment increased that amount of foraging 2-4 hours a day. Since primates are fed in a predictable fashion each day, enrichment devices, as well as the alteration of their feeding schedules, may enhance their overall heath.

Board 28 BONOBO (*PAN PANISCUS*) BIPEDALITY BY AGE AND SEX CLASSES IN RELATION TO HUMAN EVOLUTION. I. C. Scott, scott.10@osu.edu Ohio Dept of Health, Bureau of Environmental Health and Toxicology, 246 North High Street, Columbus OH 43266-0118.
The shift to bipedality was critical in human evolution. Examining bipedality in closely related species aids in understanding human bipedality. Some investigators have hypothesized that human bipedality occurred through behavior often considered sex-linked, such as the male bipedal behavior associated with hunting. For numerous anatomical, behavioral, and molecular reasons, many consider the bonobo the closest living hominoid prototype. The bonobo can be used to examine general sex-linked differences, although captive male bonobos have not demonstrated hunting behavior. Only approximately 100 captive individuals of this rare species exist. To further the few studies on bonobos, unassisted locomotor bipedality of bonobos caged indoors at the Columbus, Ohio Zoo was examined by simultaneous video taping and audio description during twelve approximately 1-hour observation periods (February to October 2001). Two male and 2 female adults, 2 male and 1 female adolescents, 1 male and 1 female juvenile, and 2 female infants were used. Slow motion and stop-frame computer analysis allowed timing and step counts of completely filmed walking bouts. Bipedal bouts per hour varied significantly (4.6, 1.7, 2.5 and 0.5) among infants, juveniles, adolescents, and adults, respectively ($P = 0.004$). Rates of bipedality varied significantly ($P = 0.001$) between all females (2.9) and all males (0.6) and between ($P = 0.01$) the oldest 3 females (2.1) and 3 males (0.3). Average number of seconds (3.3 ± 1.7) and number of steps (3.6 ± 2.3) per bout did not vary significantly. These results were inconsistent with the hypothesis that bipedality developed through male bipedal-associated behavior.

Board 29 THE OSMOREGULATORY IMPLICATIONS OF ERYTHROCYTE AND CAPILLARY DIMENSIONS IN MARINE AND FRESHWATER TELEOSTS. Erica L. Sentgeorge, sentgeel@muc.edu (Brandon Sheafor, sheafobr@muc.edu) Mount Union College, 1972 Clark Ave., Alliance OH 44601.
Marine teleosts are susceptible to water loss because they are hypoosmotic to their environment while freshwater teleosts are hyperosmotic and must protect themselves from water gain. At the same time, fish have a single ventricle and therefore cannot differentiate blood pressure between branchial and systemic circulation. High blood pressure in gill capillaries may cause a loss of fluid across capillary walls, which may be beneficial to freshwater fishes but detrimental to marine. However, low blood pressure and decreased blood flow may compromise the delivery of blood to organs and muscles. Adequate blood flow can be achieved with low blood pressure if resistance in the circulatory system is low. The majority of resistance occurs in capillaries and large capillary diameter is an effective way to maintain flow without

high pressure. There is a strong correlation between capillary and erythrocyte size in vertebrates. Erythrocytes are approximately twenty-five percent larger than the capillaries through which they pass and are deformed in transit, presumably to ensure sufficient gas exchange. This experiment will quantify dimensions of erythrocytes and capillaries in both marine and freshwater teleosts. Comparisons between six freshwater and six marine fishes will determine if osmoregulatory selective pressures have produced significant differences in circulatory resistance. Fish will be anesthetized and a ventricular cannula surgically inserted. Blood will be drawn and the circulatory system flushed with isotonic saline followed by fixation of capillaries with 1.8% buffered gluteraldehyde. Erythrocyte and capillary diameters will be determined microscopically using digital analysis of perfused tissues.

Floristics and Plant Biology
2:00PM Saturday, April 6, 2002
Battelle Hall 115
Brian C. McCarthy-Presiding

2:00 FLORA AND VEGETATION OF A NEOTROPICAL SAVANNA IN NORTHERN BELIZE, CENTRAL AMERICA. Jessica E. Woo, wooje@muohio.edu Dr. Michael A. Vincent, and Dr. John Vankat, Miami University Dept of Botany Pearson Hall Oxford OH 45056.
Savannas cover extensive areas of the Neotropics. There is a suite of factors that influence the vegetation of savannas, including climate, soil chemistry, soil drainage, and human activity. Our objective is to characterize the flora and vegetation of a Belizean savanna. The study site encompasses approximately 1 km^2 of the savanna community at Monkey Bay Preserve, a private preserve located in Northern Belize. Four 1 x 2 m plots were centered within each of 21 10 x 50 plots to obtain data on vegetation cover and environmental factors. Detrended Correspondence Analysis (DCA) and regression analyses were utilized to examine the relationship between vegetation and environment. Two communities, northern and southern sites, were different along the first axis of DCA. Two sample t-tests of environmental variables indicated elevation, percent slope, organic matter, P, Mg, Ca, CEC, Mn, and Fe were significantly different between communities ($p<.05$). 109 species in 50 families have been collected and identified.

2:15 A GIS MAP OF LICKING COUNTY, OHIO: VEGETATION AT THE TIME OF THE FIRST GOVERNMENT LAND SURVEYS. J. Michael Becher, becher_j@denison.edu Amanda B. Fuller, abfuller@students.wisc.edu Institute for Environmental Studies, University of Wisconsin, Juliana C. Mulroy, mulroy@denison.edu Dept of Biology, Denison University, Granville OH 43023.
Since Paul Sears (1921) published a method for compiling early surveyors' witness tree data into a vegetation map, Ohio botanists have been at the forefront of pre-European settlement vegetation mapping. Ohio State botanist Transeau and his students mapped the majority of the state's counties in a series of ongoing projects culminating in the publication of Gordon's 1966 map, "Natural Vegetation of Ohio at the Time of the Earliest Land Surveys." Licking County, however, was omitted from the Ohio State projects. We created a digitized map of Licking County to characterize the county's pre-settlement vegetation and to allow comparisons between pre-settlement vegetation and other spatial data using Geographical Information Systems. To create the digital map, General Land Office records of witness trees were digitally transcribed onto a point theme using a Digital Raster Graph compilation of topographic maps for Licking County as a backdrop. Additional data such as surveyor's field notes were used to provide qualitative information for areas where witness tree data were not available. Five distinct vegetation types (beech-maple, oak-hickory, oak-hickory-chestnut, mixed mesophytic, and elm-ash-maple swamp forest) were identified within the county. Beech-maple dominated the Wisconsain-glaciated western portion and oak-hickory and oak-hickory-chestnut dominated the unglaciated eastern portion of the county.

2:30 EFFECTIVE POPULATION SIZE IN THE CLONAL, SELF-INCOMPATIBLE PLANT, *HYMENOXYS HERBACEA*. Lesley G. Campbell[1], campbell.633@osu.edu Brian C. Husband[2], bhusband@uoguelph.ca [1]1735 Neil Ave., Dept of Evolution, Ecology and Organismal Biology, Ohio State University, Columbus OH 43210 and [2]Dept of Botany, University of Guelph, Guelph ON.
Mating type diversity in populations of self-incompatible plants will decrease when effective size (N_e) is less than 50, due to the impact of genetic drift on SI allele frequencies. To evaluate the impact of genetic drift on the clonal, self-incompatible plant *Hymenoxys herbacea* we 1) estimated effective size (N_e) in two populations, under field conditions, using a demographic model for clonal plants, and 2) compared allozyme diversity to population size in 13 populations. Effective size was 2831 and 5856 in the two populations respectively and averaged 43% of the census population size. Elasticity analysis revealed that N_e was most sensitive to changes in the survival and frequency of non-reproductive adults, and variation in asexual recruitment had a much larger impact than sexual reproduction. The percentage of the nine loci that were polymorphic ranged from 11 to 44% (mean = 31); Nei's gene diversity averaged 0.2035 (SE = 0.08). There was a significant relationship between allozyme diversity and population size (N or N_e). These results suggest that genetic drift is detectable in *H. herbacea* populations but most populations are sufficiently large that its effect on SI allele diversity is negligible.

2:45 A PHYLOGENETIC ANALYSIS OF CRYPTIC MOONWORT SPECIES (*BOTRYCHIUM* s.s.: OPHIOGLOSSACEAE) USING rbcL AND trnL-F DNA SEQUENCES. Heather M. Hawke, hawke_h@denison.edu (Warren D. Hauk, hauk@denison.edu) Slayter Box 1223, Denison University, Granville OH 43023.
Botrychium sensu stricto (s.s.), a group of ferns commonly called the moonworts, have a worldwide distribution, although the center of species diversity is in the mountains of western North America. Due to their relatively small size and simple morphology, species of *Botrychium* s.s. have been designated as "cryptic species". Thus, recognition and classification of moonwort species is challenging. The main goal of this research is to establish the evolutionary relationships among individual species using a molecular phylogeny. A phylogeny of moonworts constructed from DNA sequences of the plastid rbcL gene has already been established. However, this phylogeny contained 21 of the 24 currently recognized species in *Botrychium* s.s.. Thus, three species were not included. Using the rbcL gene, as well as the plastid trnL-F spacer region, the three remaining species (*Botrychium pallidum, Botrychium boreale, and Botrychium gallicomontanum*) will be sequenced and added to the molecular phylogeny. *Botrychium pallidum* is a key diploid, and is currently thought to be one progenitor of *Botrychium minganense* based on morphological similarities. *Botrychium boreale* and *Botrychium gallicomontanum* are putative tetraploids, and the identity of the chloroplast parents of these two species is unknown. The DNA sequences generated by this study should reveal the chloroplast parent of each of these species, and establish a more complete phylogeny of *Botrychium* s.s. species.

3:00 MICROBIOTIC CRUST COMMUNITIES FIX NITROGEN IN A TEMPERATE OAK SAVANNA. Roberta M. Veluci[1], rveluci@hotmail.com Kelly Ketcham[2], kellybones@yahoo.com Deborah A. Neher[1], dneher@uoft02.utoledo.edu [1]Dept of Earth, Ecological and Environmental Sciences, Mailstop 604, University of Toledo, Toledo OH 43606, [2]Bowling Green State University.
Microbiotic crust is a biological soil crust composed of lichens, cyanobacteria, green algae, mosses, and fungi. Although crusts are known to be a dominant source of nitrogen input and stabilize soil surfaces to resist erosion in arid ecosystems, this study is the first one to examine ecological function of crust communities in xeric patches of temperate habitats. The study site is located within the Oak Openings Metropark of Northwest Ohio (41° 42′ 38″ N, 83° 41′ 8″ W). Using an acetylene reduction technique, we demonstrated that nitrogen fixation occurs in these crusts. Based on video imaging analysis of crust surface cover, proportion of moss cover explained more nitrogen fixation ($p=0.0212$) than did lichen, cyanobacteria or no cover ($p\geq 0.15$). Fluorescent microscopy ($n=72$) revealed that moss surfaces are covered with cyanobacteria responsible for fixing nitrogen. Looking at the effect of depth, populations of cyanobacteria were greater on moss surface (0-30 mm) than subsurface (31-60 or 61-90 mm) strata of these crusts ($p<0.0001$). Based on the assumption that moss tends to occur only in late successional and well-established crusts, these data support our hypothesis that more nitrogen fixation occurs in well-established crust than intermediate or non-established crust. This study identified an important ecological function of microbiotic crust communities to promote conservation of lands with this habitat.

3:15 *ATRIPLEX PROSTRATA* (CHENOPODIACEAE) SEED DORMANCY AS INFLUENCED BY LONG-TERM COLD STORAGE. Christy T. Carter, ct346390@ohio.edu Lorena S. Brown and Irwin A. Ungar, Dept of Environmental and Plant Biology, Porter Hall, Ohio University, Athens OH 45701.
Atriplex prostrata produces two seed morphs. The larger brown seeds germinate readily when produced and the smaller black seeds require a cold stratification treatment to promote germination. While the seed morphs exhibit two different dormancy types, physiological changes in dormancy cycles may be slowed or altered during cold storage. We investigated the effects of long-term cold storage on the dormancy of dimorphic seeds of *A. prostrata* to determine whether these stored seed morphs exhibited annual changes in their dormancy cycles. *Atriplex prostrata* fruits collected in 1998 from an inland salt marsh in Rittman, Wayne Co., Ohio, were stored dry at 5°C. Beginning in April 2000, 25 large and small fruits each were placed in 50 mm petri dishes with filter paper and 2 ml distilled water. Four replicates of each seed type were exposed to four temperature regimes (5/15°C, 5/25°C, 15/25°C and 20/35°C; 12h-night/12h-day) at monthly intervals over a one-year period. We found a significant interaction of seed size, temperature and month ($p<0.05$) on the germination of *A. prostrata* seeds. The capacity of seeds to germinate at different temperature regimes during storage at 5°C varied with the month that seeds were removed from the cold treatment. Large seeds had their highest rate of germination in 20/35°C temperatures whereas small seeds showed the highest rates of germination in 5/25°C temperatures. Our data indicate that both seed types maintain endogenous rhythms of dormancy as indicated by their germination patterns.

3:30 EFFECTS OF ORGANIC MULCHING AND FERTILIZING TREATMENTS ON POPULATIONS OF RIVER BIRCH ECTOMYCORRHIZAS
Jennifer H. Wagner, wagner.365@osu.edu (Dr. Pierluigi Bonello bonello.2@osu.edu) The Ohio State University, Dept of Plant Pathology, 2021 Coffey Road Room 201 Kottman Hall, Columbus OH 43210.
A relative lack of research on the effects of compost in plant production and establishment is an obstacle to the rational use of this environmentally friendly resource. Mycorrhizas are symbiotic associations between some soil-borne fungi and the root systems of the majority of plants that have been demonstrated to be beneficial to the fitness of the plant hosts. In general, mycorrhizal colonization has been shown to improve the health status of trees. This study quantified and partially characterized populations of ectomycorrhizal fungi colonizing the roots of River birch (*Betula nigra)* trees grown in experimental plots under different treatments that included mulching with composted yard waste and shredded wood pallets, and N-P-K fertilization. The various mulching and fertilization treatments, alone and in combination, were expected to elicit changes in ectomycorrhizal populations. The procedure consisted of isolation, quantification, and morphological typing (i.e. morphotyping) of the ectomycorrhizae. Treatment appeared to affect the occurrence of morphotypes with a slightly higher diversity being found in the yard waste plots. Fertilization appeared to affect total root mass/length, while mulching significantly increased colonization percentage. Results of this study suggest that use of compost in tree establishment and maintenance may indirectly contribute to overall tree health by increasing natural mycorrhizal infection. Thus, this study indicates that composted soil amendments may be a viable and superior alternative to mineral fertilization.

3:45 APOSEMATIC (WARNING) COLORATION IN VASCULAR PLANTS OF SOUTHEASTERN OHIO. Brian C. McCarthy, mccarthy@ohio.edu and Darrin L. Rubino, Dept of Environmental and Plant Biology, Ohio University, Athens OH 45701.
Aposematic coloration, the use of conspicuous colors to advertise unpleasant qualities to potential predators, is well documented in the animal kingdom. However, similar use of warning coloration in plants to advertise physical armaments (spines, thorns, or prickles) has been, until recently, unreported. The hypothesis was that plants using aposematic coloration to advertise physical armaments might be protected from future bouts of herbivory if herbivores associate color or a color pattern with unpleasantness. The goals of this investigation were to document the presence of aposematic coloration in the native and naturalized flora of southeastern Ohio (USA). Additionally, we wanted to gain a rudimentary idea regarding the commonality of this phenomenon among various taxonomic groups in the region. We defined aposematic plants as those with thorns, spines, or prickles that are colored so that they contrast with the vegetative structure(s) (leaf, stem, twig, rachis, petiole) on which they are borne. A high incidence of aposematism was observed in the plants of the region. Physical armaments of a wide range of color (white, yellow, yellow-green, red, maroon, tan, brown, and black) and color patterns were observed. Furthermore, aposematic coloration was found in a wide variety of genetically diverse taxa. We noted aposematic coloration in 44 species distributed among 23 genera in 17 families. Not all plants with physical armaments exhibited aposematic coloration. Future research into the possible role of aposematism in vascular plants could greatly expand our knowledge of plant-herbivore interactions.

4:00 DOES INDUCIBLE ANTIBIOTIC RESISTANCE IN *ESCHERICHIA COLI K12* INVOLVE THE ACETYL PHOSPHATE PATHWAY?
Abhishek Saharia, saharia@acs.wooster.edu (Dr. Dean Fraga), Dept of Biology, College of Wooster, Wooster OH 44691
The use of antibiotics in the treatment and prevention of bacterial diseases in both humans and animals in the last 75 years has lead to the increase in the number of bacterial strains that are resistant to antibiotics. It has recently been observed that the resistance to antibiotics in *E. coli K12* can be induced using chemorepellents such as sodium acetate. Chemoattractants, such as (L)-Aspartic acid, on the other hand, have been shown to increase susceptibility to antibiotics. This has been shown to occur in the absence of the *mar* operon, an operon initially thought to be the cause of inducible antibiotic resistance in *E. coli*. An alternative regulatory mechanism via acetyl phosphate regulatory pathways is proposed, since it has been shown to regulate the expression of outer membrane proteins (OmpF and OmpC). These proteins are thought to play a role in inducing antibiotic resistance. Thus, we have hypothesized that chemoattractants and chemorepellents may play a role in the level of antibiotic resistance in *E. coli* by affecting the levels of acetyl phosphate and indirectly affecting the levels the Omp proteins in the cell. This model shall be tested using acetyl phosphate regulatory mutants (which are unable to produce acetyl phosphate) to test whether antibiotic resistance may be induced in these backgrounds. If the acetyl phosphate regulatory mutants do not induce antibiotic resistance, the hypothesis that acetyl phosphate is important for this pathway can be demonstrated.

ECOLOGY AND BIODIVERSITY
9:00AM SATURDAY, APRIL 6, 2002
BATTELLE HALL 115
DAVID J. HORN-PRESIDING

9:00 VEGETATION-ENVIRONMENT RELATIONSHIPS OF OLD-GROWTH HEADWATER RIPARIAN AREAS OF NORTH-CENTRAL OHIO.
P. Charles Goebel, goebel.11@osu.edu David M. Hix, Clayton E. Dygert, and Kathryn L. Holmes, School of Natural Resources, Ohio Agricultural Research and Development Center, The Ohio State University, 1600 Madison Avenue, Wooster OH 44691.
Little is known concerning the composition and structure of the ground-flora in Ohio's riparian forests prior to European settlement, yet these forests as a whole are perhaps one of the most altered in the state. We initiated a study to examine the vegetation-environment relationships of the riparian areas associated with a small intermittent, headwater stream located in Johnson Woods State Nature Preserve, a 206 acre old-growth forest remnant located in north-central Ohio. Using transects arrayed perpendicular to stream flow, we sampled the ground-flora vegetation (herbaceous and woody plants < 1 m tall) and soils of 193 1 m^2 plots. Using TWINSPAN, we classified the most common ground-flora species (28 out of a total of 75) into eight species groups, each with characteristic patterns of distribution. Ordination analyses of these 28 species indicate that ground-flora vegetation is strongly related to a variety of environmental factors, including distance from the bankfull channel, organic matter content, and finer texture soils. This suggests that ground-flora species are ordered along a complex environment from the stream edge to the uplands. Although we observed no significant differences in species richness between the floodplain and upland landforms sampled, there are differences in functional lifeform guilds. Specifically, graminoids, annual forbs, and perennial forbs dominate the floodplains, while woody seedlings and vines dominate the adjacent uplands. While these old-growth riparian forests are an unrealistic target for many of the highly disturbed riparian systems in northeastern Ohio, the results suggest that the restoration of riparian ground-flora communities should focus on maintaining a diverse array of plant functional guilds in these headwater systems, rather than the traditional single species grass-tree buffers that are currently being restored along many streams in north-central Ohio.

9:15 TESTING MECHANISMS RESPONSIBLE FOR THE LATITUDINAL GRADIENT OF SPECIES DIVERSITY.
Martin H.H. Stevens, Hstevens@MUOHIO.EDU 316 Pearson Hall, Dept of Botany, Miami University, Oxford OH 45056, and J. Price, Rutgers University, L. Kerkhof, Rutgers University, and P. J. Morin, Rutgers University.
Biodiversity generally increases from the poles to the tropics. Different explanations for this diversity gradient focus on either the maintenance of diversity (*ecological mechanisms*) or the generation of diversity (*evolutionary mechanisms*). In a queer twist of fate, ecologists have neglected to replicate the planet in order to perform the necessary experiments. We used laboratory microcosm communities where "climate" scaled to the generation time of protists and bacteria to test whether ecological explanations could explain the latitudinal diversity gradient. If ecological mechanisms drive the global diversity gradient, then short term experimental treatments that mimic latitudinal variation in climate should result in diversity peaking in tropical treatments. We imposed a complex laboratory-climatic gradient on aquatic laboratory microcosms containing bacteria, protists, and small metazoans. Our gradient consisted of five treatments: polar, subpolar, temperate, subtropical, and tropical treatments. We scaled seasonal variability to the generation time of protist ciliates, so that 1-3 generations of ciliates would occur in four microcosm seasons, or one microcosm year. These treatments had mean temperatures of 2, 4, 8, 16, and 24 degrees Celsius and seasonal ranges of 0, 2, 6, 8, and 0 Celsius degrees, respectively. These light and temperature combinations mimicked the long-term averages, seasonal variability and diurnal variability of temperature and light along the earth's latitudinal gradient. Ciliate protist diversity peaked in subpolar and temperate treatments, and multiple polynomial regressions found that species richness was most closely related temperature range. These results are not consistent with ecological mechanisms, but rather, are most consistent with evolutionary explanations for the latitudinal gradient of species diversity.

9:30 ALL-TAXON BIODIVERSITY INVENTORY OF DEEP WOODS, HOCKING COUNTY, OHIO.
David J. Horn[1], horn.1@osu.edu Cynthia L. Riccardi[2], cr468188@oak.cats.ohiou.edu Brian J. Armitage[3], armitage.7@osu.edu Dept of Entomology, The Ohio State University, Columbus OH 43210, [2]Dept of Environmental and Plant Biology, Ohio University, [3]Ohio Biological Survey.
Deep Woods is a 114-hectare parcel in Benton Twp., Hocking Co., which contains a rich variety of habitats, from early seral stages (mowed lawn, old fields) through mature oak-hickory and beech-hemlock maple forests. A riparian corridor and topographical relief generate microhabitats. In 1998 the Ohio Biological Survey and Ohio Division of Wildlife initiated an All-Taxon Biodiversity Inventory to document

animal and plant species of Deep Woods, with special attention to species that are rare and/or of restricted distribution. All major habitats have been sampled systematically, using visual observation (terrestrial vertebrates), electroshocking (fish), pitfall, Malaise and blacklight traps (invertebrates), litter extraction (microarthropods) and vegetation transects. Species determinations are entered into a database that includes precise location and pertinent ecological information (such as plant-insect associations). Species documented to date are: Algae, 151; Lichens, 38; Vascular Plants, 341; Arthropods, 1300; Mollusks, 27; Fish, 22; Amphibians, 18; Reptiles, 20; Birds, 125; Mammals, 33. Surveys of bryophytes and fungi will be initiated in 2002. Several arthropods (*e.g.* the craneflies *Pedicia vernalis* and *Tipula fraterna*, the ground beetle *Harpalus somnulentus* and 11 species of Collembola) have not been previously reported from Ohio. Several rare plant species (*e.g.* round-leaved catchfly) and unusual vertebrates (smooth earth snake, blue grosbeak) have been documented. The study provides a valuable baseline for characterizing the flora and fauna of unglaciated Ohio including nearby parks, state and private forests, and natural areas. The biodiversity of Deep Woods is of particular interest due to strong pressure for economic development in rural southeastern Ohio.

9:45 COMPOSITION, STRUCTURE, AND DIVERSITY OF THE WOODY REGENERATION LAYER OF THREE MIXED-OAK FORESTS IN SOUTHEASTERN OHIO. Matthew A. Albrecht, ma323500@ohio.edu Brian C. McCarthy, mccarthy@ohio.edu Ohio University, Dept of Environmental and Plant Biology, 317 Porter Hall, Athens OH 45701.

Developing an advance regeneration layer of mixed hardwood species is important if forest managers are to successfully regenerate mixed-oak forests in the central Appalachians. The primary objective of this study was to aid forest managers by characterizing the composition, structure, and diversity of the woody regeneration layer of three forests in southeastern Ohio (Raccoon Experimental Management Area (REMA), Tar Hollow State Forest, and Zaleski State Forest). Tree seedlings and saplings were surveyed in 300 m^2 plots distributed across 12 stands within the three forests. Seedlings and saplings were each divided into three size classes based upon height and diameter. Mean density of saplings per ha was significantly greater at REMA (1693.3 ± 97.5) than at Tar Hollow (1238.5 ± 45.9) and Zaleski (886.7 ± 66.9). However, the density of seedlings per ha was significantly greater at Zaleski (97825 ± 7143.9) than at REMA (64187.5 ± 4486.0) and Tar Hollow (75650 ± 7077.2), indicating lack of tree seedling advancement into the sapling layer at Zaleski. The Shannon-Weiner Diversity Index revealed that REMA had a significantly greater diversity than Tar Hollow and Zaleski at both the seedling and sapling stratum. A detrended correspondence analysis (DCA) of both the seedling and sapling stratum showed a distinct separation of Tar Hollow from REMA and Zaleski, suggesting a marked difference in the species composition of the regeneration layer at Tar Hollow compared to REMA and Zaleski. Land use history is the most likely factor driving compositional and structural differences between sites.

10:00 FUEL LOADS IN SOUTHEASTERN OHIO MIXED OAK STANDS. Cynthia L. Riccardi, cynthia.riccardi.1@ohio.edu Brian C. McCarthy, mccarthy@ohio.edu Dept of Environmental and Plant Biology, Ohio University, Athens OH 45701.

Researchers have developed fuel models to predict and describe forest fire behavior and intensity. Components of fuel models include characteristics of fuels, vegetation, and environmental conditions. Two primary determinants of fuel models are fuel load and particle size. To elucidate fuel loads in the Central Hardwoods region, ground and surface fuels were measured along seventy-two 20 m transects in twelve mixed oak stands, four each within three forest sites (Raccoon Ecological Management Area (REMA) and Tar Hollow (TH) and Zaleski (Z) State Forests). Ground fuels included Oi, Oe and Oa forest floor layers (litter and duff). Mean mass of ground fuel was 145.75 (±2.67 SE), 69.78 (±1.57), and 58.96 (±1.08) $g \cdot mm^{-2}$ for REMA, TH and Z, respectively. Surface fuels included 1-, 10-, and 100-hr fine fuels and woody debris as well as 1000-hr coarse woody debris (CWD). Surface fuels at REMA, TH and Z were 0.325 (±0.01), 0.377 (±0.09), 0.349 (±0.01) for 10-hr, 1.32 (±0.06), 1.99 (±0.07), 2.04 (±0.08) for 10-hr and, 1.48 (±0.13), 1.90 (±0.13), 1.99 (±0.11) $MT \cdot ha^{-1}$ for 100-hr fuels, respectively. Volume of CWD was 66.82 (±5.15), 44.15 (±5.16) and 52.94 (±9.51) $m^3 \cdot ha^{-1}$, respectively. Differences in fuel loads were found among the forests (1-hr: $F = 8.03$, $P = 0.0004$; 10-hr: $F = 34.4$, $P < 0.005$; 100-hr: $F = 4.77$, $P = 0.009$; and 1000-hr: $F = 2.72$, $P = 0.067$). CWD volumes are consistent with other hardwood forests. Fine fuel loads are stand and site specific, perhaps due to various factors associated with sampling, aspect, and stand age. Some of these factors will likely serve as covariates in fuel models developed for the Central Hardwoods region.

10:15 DISTRIBUTION OF TREES, SAPLINGS, AND COARSE WOODY DEBRIS ACROSS VARYING TOPOGRAPHIC GRADIENTS IN A MIXED-OAK FOREST OF SOUTHEASTERN OHIO. Darrin L. Rubino, dr246988@ohio.edu and Brian C. McCarthy, Dept of Environmental and Plant Biology, Ohio University, Athens OH 45701.

Elucidating relationships between topographic gradients and forest stand composition has long been an objective of forest ecologists. The goal of this investigation was to determine the influence of several environmental parameters on the composition and distribution of overstory, understory, and coarse woody debris (CWD; logs ≥ 10 cm diameter) species in a mixed-oak forest of southeastern Ohio. Trees, saplings, and CWD were measured and identified in fifty 500 m^2 plots stratified across slope aspect and slope position. To explore relationships between overstory and understory species composition and topographic gradients, redundancy analysis (RDA) was performed. RDA revealed that tree species' distributions were significantly related ($P < 0.001$) to the measured environmental and vegetation parameters (slope aspect, percent slope, topographic position, plot age, canopy cover, and maximum tree height). RDA of sapling species' distributions were also significantly related ($P < 0.001$) to the measured environmental and vegetation parameters (slope aspect, percent slope, topographic position, plot age, canopy cover, maximum tree height, tree basal area, and tree density). Oak (*Quercus* spp.) and *Acer rubrum* trees and saplings reached their highest importance in more xeric plots (steep, upper-slope, and/or southwest-facing plots). Canonical correspondence analysis revealed no significant relationship between CWD species and the measured environmental and vegetation parameters. CWD density was significantly correlated ($r = 0.299$; $P = 0.03$) with slope position with higher densities in valleys than on ridges. Also, oak CWD was significantly correlated ($r = 0.481$; $P < 0.001$) with overstory oak importance. Topographic gradients proved to be of predictive value in describing overstory and understory species composition but not for CWD species distributions.

10:30 CLASSIFICATION AND CHARACTERIZATION OF FOREST ASSOCIATIONS WITHIN AN OHIO NATURE PRESERVE. Beth E. Krisko[1], bethkrisko@hotmail.com Robert S. Whyte[1], rswhyte@antioch-college.edu Orie L. Loucks[2], loucksol@muohio.edu [1]Antioch College, Glen Helen Ecology Institute 405 Corry St. Yellow Springs OH 45387 and [2]Miami University, Dept of Zoology, Oxford OH 45056.

Glen Helen is a 1,000-acre nature preserve and environmental education facility located in Greene County, Ohio. The land, given as a gift to Antioch University in 1929, is currently owned by the college and managed by the Glen Helen Ecology Institute (GHEI). For the natural areas, GHEI seeks to develop a long-term management plan. Critical to this process is an understanding of the full range of forest community diversity. Based on existing vegetation and total woody species composition, forest vegetation was sampled, characterized, and mapped. Transects were established and walked, qualitatively describing composition and structure of vegetation and physical attributes of the landscape. Along each transect, where topography and plant composition were uniform according to field observation, plots ($N = 100$) were randomly established and measurements taken to obtain values of relative cover for overstory species and density for overstory and understory species. Using Principal Component Analysis (PCA), plots were grouped into 12 dominant types. For individual dominant classes which contained more than four plots, PCA was used to further differentiate associations. Twenty-four distinct association types were found. Each association was named by dominant and differentiating species, and characterized by dominate, differentiating and common species and their corresponding summary statistics, such as average dbh and height. Dominate types were mapped using qualitative description from transects, and interpretation of topographic maps, soil surveys, and historical and current aerial photos. Individual associations were mapped using plot data and qualitative field description.

10:45 EFFECTS OF HERBICIDE (ROUND-UP®) ON *ALLIARIA PETIOLATA*, AN INVASIVE BIENNIAL HERB, AND SUBSEQUENT EFFECTS ON THE NATIVE PLANT COMMUNITY IN HUESTON WOODS STATE NATURE PRESERVE. Adriane M. Carlson, carlsoA1@muohio.edu David L. Gorchov, gorchoDL@muohio.edu Miami University, Dept of Botany, Oxford OH 45056.

Alliaria petiolata (garlic mustard), an invasive biennial herb, has become established in Hueston Woods State Nature Preserve in southwestern Ohio. Due to concerns about its impact on native species, the preserve has begun a multi-year eradication program using dormant season herbicide (Round-up®) treatment. To investigate the effects of Round-up® on *A. petiolata* and forest floor plants, we established 50 1x1m plots in patches of high *A. petiolata* density in each of two stands of the preserve (an old and a secondary growth stand) in May 2000. Twenty-five plots in each section were randomly assigned to be sprayed (Nov. 1, 2000), while the rest were not sprayed. All plots were censused for density of *A. petiolata* in May, June, Aug., Oct. 2000 and 2001. This census will continue through 2004. In addition, percentage cover of each vascular species and demographic data on representative forest floor vascular species were determined during the 2000 and 2001 growing season. Based on percentage cover data, species richness and diversity were calculated and detrended correspondence analysis (DCA) ordination was done to determine whether or not community changes took place due to *A. petiolata* decline. While *A. petiolata* density significantly decreased immediately after spraying in both stands (ANOVA: p=0.0002, p=0.046), density of the spring 2001 cohort was not affected. Neither richness nor diversity increased more in experimental than in control plots. However, significant overall composition changes following Round-up® treatment took place in the old growth stand (DCA Axis 1 scores ANOVA: p=0.021).

Zoology I
9:00AM Saturday, April 6, 2002
Battelle Hall 103
Jack Kovach-Presiding

9:00 INTRODUCTION AND SPREAD OF THE NON-INDIGENOUS NORTHERN STUDFISH (*Fundulus catenatus*) IN THE UPPER LITTLE MIAMI RIVER DRAINAGE. Matthew J. Greene, greene.118@osu.edu and Ted M. Cavender, Museum of Biological Diversity, 1315 Kinnear Road, Columbus OH 43212-1192.
During a recent fish distributional survey (1999-2001) of the upper Little Miami River drainage, we were able to map the current distribution of the northern studfish in the Little Miami mainstem and its tributaries near Xenia, Greene County, Ohio. The studfish is one of the 48 species found as resident population in the upper Little Miami. Based on collecting done in 1995 by the Ohio Division of Wildlife (District 4), the studfish was first located near the mouth of Massies Creek at Xenia. In 1997, the studfish was still confined to Massies Creek. By 1998 there was an established population in lower Massies Creek where all growth stages, including young-of-the-year, were collected. At that time the studfish was also taken in the Little Miami River mainstem just upstream from the mouth of Massies Creek. By the summer of 2000, the studfish had spread about 7 miles upstream in Massies Creek as far as the Cedarville Gorge area. It was also captured in the Massies Creek tributaries of Clark Run and Old Town Creek. In the Little Miami River the studfish has spread upstream to Conner Branch tributary and to Jacoby Road Bridge (RM 83.1). Downstream it spread past Fairgrounds Road in Xenia (RM 78.2). The studfish now occupies an approximately 24 square mile area of the Little Miami drainage in Xenia Township. It prefers small stream habitat where there are abundant gravel bars and backchannels with firm substrate derived from limestone.

9:15 HUMAN IMPACT ON CETACEANS IN THE HAWAIIAN ISLANDS. Larzetta DeBord, LDeBord@ursuline.edu (Britt A Bunyard, bbunyard@ursuline.edu) Biology Dept, Ursuline College, 2550 Lander Road, Pepper Pike OH 44124.
In recent years tourism, commercial fisheries, and the military have been encroaching on the habitat of several species of dolphins in and around the Hawaiian Islands. There are little or no data on the population density and distribution; therefore it is hard to determine the effects of these intrusions on the habits of the dolphins. As Hawaii considers adding night ferries and is considering allowing additional military maneuvers in the area, these studies will assist in the decision as to whether or not these projects should be reconsidered. Dolphin density data were collected through visual sightings within randomly predetermined computerized trisects. Data continues to be collected and evaluated to determine if any changes have occurred in the population distribution and density estimations of dolphins and if there exists any correlation between those changes and an increasing human presence.

9:30 INVASIVE ROUND GOBY IMPACTS ON BENTHIC MACROINVERTEBRATES IN LAKE ERIE. J Michele Pinto, michele@nwonline.net 2525 E. State St, Fremont OH 43420 and Jeffrey G. Miner, jminer@bgnet.bgsu.edu Dept of Biological Sciences, Bowling Green State University, Bowling Green OH 43403.
Two invasive species to the Great Lakes have had substantial impact on the Lake Erie ecosystem. Zebra mussels (*Dreissena polymorpha*) occupy large percentages of available hard substrate and have been shown to alter phytoplankton and zooplankton communities via their collective filtration capacity. Feces and pseudofeces from this activity, as well as increased light penetration, have altered habitat for other benthic macroinvertebrates, generally increasing abundance and diversity. Round gobies (*Neogobius melanostomus*) are specialized predators of zebra mussels and it has been predicted that at high densities, they will consume high numbers of zebra mussels, thus altering ecosystem processes. We conducted a manipulative enclosure experiment in Lake Erie (August 1997), exposing zebra mussel-dominated benthic communities to direct and indirect effects of round gobies at three densities (0, 4, and 16 round gobies m^{-2} and cageless controls). After about one month, round gobies had consumed 40-65% of the zebra mussels. In addition, richness of the macroinvertebrate community declined by 25% at the high round goby density (ANOVA, $p=0.03$). *Microtendipes pedellus*, a chironomid closely associated with zebra mussels was eliminated at the highest round goby density. Round gobies are proving to be as important an invading species as zebra mussels in the benthic habitats of Lake Erie.

9:45 ECOLOGY AND SCHOOLING BEHAVIOR OF FISHES IN REEF AND BLUE HOLE HABITATS. Jennifer M. Nicol, nicoljm@acs.wooster.edu Raymond S. Matlack, rmatlack@acs.wooster.edu College of Wooster, 1189 Beall Ave, Wooster OH 44691.
Coral reefs are known worldwide to be hotspots of fish diversity and abundance. However, little is known about the use of blue holes, underwater openings to cave systems, by fish. I studied the ecology and schooling behavior of fishes in reef and oceanic blue hole habitats in the Caribbean Sea off the coast of Andros Island, Bahamas in May of 2001. Equal effort was made to observe fish in reef and blue hole habitats, by recording their behavior, species, abundance, size, and position. Eighteen observations were made in each habitat, and 819 individuals of 58 different species were recorded. There was no significant difference in the diversity of fish species between the two habitats (reef: $H=3.116$; blue hole: $H=3.105$; $T=.15$, $P>.05$), however, species overlap between the two habitats was low (Morisita-Horn Index=.57). There were differences in size ($X^2=21.01$, $P<.001$) and age structure ($X^2=11.71$, $P<.001$) of schools in blue hole and reef habitats. Larger schools, and more adult fish were found in blue hole habitats than on reef habitats. The distance between individual fish in schools is also greater in blue holes than reef habitats ($X^2=18.14$, $P<.001$). There appear to be differences in the way fish use the two habitats, despite the physical closeness of the two habitats in space. Differences in size and age structure observed between the habitats may indicate that the habitats are used by fish in different stages of their lives.

10:00 MUSKRAT PREDATION ON THE INTRODUCED VIVIPARID SNAIL, *BELLAMYA (CIPANGOPALUDINA) JAPONICA*, IN SALT FORK LAKE, GUERNSEY COUNTY, OHIO - EATING ONE'S ESCARGOT AND HAVING IT TOO. Jack Kovach, jkovach@muskingum.edu Geology Dept, Muskingum College, New Concord OH 43762.
Muskrats (*Ondatra zibethicus*), generally considered herbivorous, are voracious predators of freshwater clams, posing a threat to some populations of endangered species (Neves and Odom, 1988). Observations on muskrat molluscivory, which, while extensive, may not jeopardize the prey base, are reported here. Live and dead adult and subadult *Bellamya japonica* with their opercula missing and with part or most of their large, muscular foot bitten off by muskrats have been found singly or in clusters ("middens") of up to 64 individuals on dozens of occasions from September 1993 to present in shallow waters (0-0.5 m deep) along the shoreline of Salt Fork Lake. The author has observed no actual incidents of muskrats preying on these snails, as the activity is apparently nocturnal. However, the finding of muskrat feces that are pink in color (from consumption of large amounts of animal tissue) rather than the typical dark-green color of most muskrat droppings, and of up to 2,064 dead shells of this large snail heaped at underwater entrances to muskrat burrows, clearly implicate muskrats as predators of these snails. Vital organs of the snails are protected from consumption by the relatively thick adult shell, and muskrat-predated snails whose foot has been largely consumed can survive in the laboratory for up to a week. Some gravid females of this viviparous species, predated in the manner described and transported to the laboratory, were observed on several occasions to give birth to up to 60 viable young before they expired – a clear example of muskrats eating their escargot and having it.

Zoology II
2:00PM Saturday, April 6, 2002
Battelle Hall 103
Nancy J. Swails-Presiding

2:00 EFFICACY OF RECORDED ALARM AND ALERT CALLS FOR GOOSE DISPERSAL. 0077. Luke A. Streng, lstreng@capital.edu Capital University, Dept of Biology, 2199 East Main St., Bexley OH 43209.
Giant Canada geese, *Branta Canadensis Maxima*, are a nuisance species in urban settings where they seek manicured lawns of residences, corporate parks and golf courses. From March to August 2001, six weeks of research were conducted to evaluate the use of playback of recorded alarm calls as a means to disperse several hundred flightless geese and goslings from 10 hectares of grass test growth test plots at a local lawn and garden corporation headquarters. Calls were played at a randomized 7-10 minute intervals dawn to dusk using Bird Expeller units (Bird X Corp. Chicago Il.) Modified to play recorded alert and alarm calls series by the author's advisor, Dr. Philip Whitford, during dissertation research on Canada goose vocal communication. On First activation, call playback caused all geese present to vacate a 16+ hectare area of ponds for two weeks after the call units were activated. Complete elimination of geese occurred for the first four days. Habituation began after some 1200 repetitions of call playback and geese resumed feeding on the test plots. Call units were shut off for three weeks after two weeks of continual playback, to assess goose memory for the specific alarm/alert calls used and thus to evaluate whether habituation observed was retained for at least three weeks. Geese appeared to recall the call and still ignored it following the three-week "off" period.

2:15 BONOBO BEHAVIOR: AN ACTIVITY BUDGET ON A CAPTIVE GROUP OF BONOBOS. Ami L. Jones, amijones@worldnet.att.net (Dr. Phil Whitford, pwhitfor@capital.edu) Capital University 2199 E. Main St. Columbus OH 43209.
Little behavioral documentation has been amassed on the bonobo, which differs from the common chimpanzee. This study gives a preliminary finding of the more intensive research undertaken by Monique Fortunato, a graduate student from the University of Buffalo. In an effort to examine daily activities, an activity budget was constructed

using multiple categorical states, including AB (abnormal), AG (aggressive), EX (exploration), FD (feeding), IA (inactive), OT (other), PL (play), SO (social), and TE (tension). Over sixty hours of fifteen-minute individual behavior samples have been compiled and analyzed. The group observed at the Columbus Zoo in Columbus, Ohio, the largest captive group of bonobos publicly available, is composed of a varied age range of individuals with nearly equal representation of both sexes, and thus provides a rich sample from which an activity budget can be extracted. Bonobos are female-dominated, female centric, and typically exhibit low levels of aggressive behavior. In that females represent the social core of the group, they are expected to spend more time than males engaged in social behaviors. Adults are expected to spend more time in an inactive state than the juveniles and infants, who exhibit more playful behaviors. All behavioral states are compared statistically on the basis of age and sex class. The activity budget will provide an account of the daily activities of bonobos at the Columbus Zoo, and may be used in comparative studies of captive versus wild group observations.

2:30 PRIMARY SENSE SWITCHING IN COURTSHIP IN THE BROWN TREE SNAKE (*Boiga irregularis*). D. E. Gee II, geede@wooster.edu The College of Wooster, C-1646; 1189 Beall Ave, Wooster OH 44691.

Sensory cues important to brown tree snakes (BTS) have been compared in the context of foraging, but not in other settings. In foraging, vision is the primary sense used for searching. Other senses are used when the visual cue is inadequate or absent. In courtship, only pheromonal cues have been examined, so their importance relative to other stimuli in not known. Female BTS pheromonal cues have been demonstrated as releasers and inhibitors of courtship in males, but visual mate searching and/or identification have not yet been considered. To examine this four male BTS were given a choice between a filter paper treated with the non-volatile attractive female sex pheromone and an actual female. It was hypothesized that the males would choose to approach the female rather than court the filter paper. The filter paper was placed so that it was the first stimulus that the male encountered, and the choice was recorded as whether the male subsequently courted the filter paper or approached the female for courtship. Each male was given seven trials, each with a different female. Another such trial was conducted for each male in which the female visual stimulus was replaced by a rope on the floor. In 21 of 28 trials the males' response was to court the live females; they courted the rope in three of four trials. The null hypothesis is therefore rejected. These results might be expected in a taxon that is primarily visually guided. Pheromone detection and trailing are important, but sense modalities may be switched when one cue is dominant to another – for example, a pheromone may be trailed until visual contact with a potential mate is made, when the primary sense is switched from olfaction to vision.

2:45 A PUZZLING TELOTROCH Jennifer A. Tieche, jtieche@capital.edu Biological Sciences Dept, Capital University, 2199 E. Main St., Columbus OH 43209.

This photographically well-documented research report describes the development of an unusual telotroch (the free-swimming, re-colonizing stage) from a zooid that was broken-off from a spasmoneme-bearing, colonial, contractile, stalked Peritrich protozooan. Under duress created by extensive microscopic viewing, zooids would break free from the observed Peritrich specimens and subsequently die. But in one instance, a detached zooid survived and appeared to successfully make the transformation from zooid to telotroch in its detached state. Microphotographs were taken at approximately five-minute intervals and show the transformation of a small, elf-cap shaped, detached zooid into a telotroch resembling that of a *Zoothamnium* macrozooid. The oddity of this transformation is increased by the placement of the ciliary girdle at the scopular end of the zooid, while the oral zone remained wide.

3:00 COMMUNITY STRUCTURE OF SCLERACTINIAN CORALS AT THE PARAISO NEARSHORE FRINGING REEF CREST, COZUMEL ISLAND, MEXICO. John F. Vitullo, jvitullo@capital.edu Dept of Biology, Capital University, 2199 E. Main St., Columbus OH 43209-2594.

Coral reef community structure and its effectors are not well understood by the marine research community. Research and quantitative analysis were conducted on the near-shore crest environment at Paraiso reef, Cozumel, Mexico, to investigate scleractinian coral relative abundance based on head sizes of $1m^3$, $3m^3$, and $5m^3$. To elucidate any underlying patterns that govern Caribbean species diversity and abundance with respect to head size, it was hypothesized that each coral head size exhibits a different diversity of included coral species. Data collection utilized self-contained underwater breathing apparatus (SCUBA) during five 50-minute dives spanning January 8, 9, and 10, 2001. These dives permitted species identification and collection of percent head coverage data of species on 7 sets of $1m^3$, $3m^3$, and $5m^3$ coral head communities. Data analysis compared the relative abundance and diversity of species on varying size coral heads. Our hypothesis was supported via reasonable Cohen's *d* in species diversity between head sizes of $1m^3$ and $3m^3$, $1m^3$ and $5m^3$. Cohen's *d* provides a standardized difference between two groups with congruent variances. No difference was determinable between $3m^3$ and $5m^3$ heads.

3:15 EFFECTS OF LAND USE ON PREDATION LEVELS OF EXPERIMENTAL NESTS IN FOREST FRAGMENTS OF NORTHEASTERN OHIO. Alexander J. Pries; priesaj@acs.wooster.edu (Raymond S. Matlack, rmatlack@acs.wooster.edu) Dept of Biology, College of Wooster, Wooster OH 44691.

Destruction of forested lands in the eastern United States and further fragmentation of these lands has been viewed as a reason for recent precipitous declines in certain avifauna populations, particularly migrant species. Nest predation has been cited as a possible explanation for these population declines. Additionally, it has been suggested that the type of land use activity outside of fragments may influence predation on nests. I explored the influence of both land use patterns outside of a fragment, and fragment size, on nest predation of experimental nests. I expected to find that the land use outside of a forest fragment has an influence on nest predation levels. I used four forest fragment sites, 2 sites surrounded predominately by urban development and 2 sites surrounded predominately by agriculture. All fragments were roughly 2.5 ha in size. I also selected two sites in a continuous forest of 2040 ha. I sampled the sites with artificial nests for 4 weeks. Predation rates were higher in fragments than in the continuous forest. Predation rates were similar in agricultural and urban fragments and were high in all habitats examined (average of 85% of nests predated). Predation rates at all sites increased over the course of the study. Using geographic information systems (GIS), I will examine the relationship between nest predation rates and land use patterns by modeling predation rates as a function of land use.

3:30 REPTILES IN AN AGRICULTURAL LANDSCAPE: USE OF GIS AND ROAD-SURVEY DATA. Raymond S. Matlack[1], rmatlack@wooster.edu Ryan L. Rehmeier[2], ryman@ksu.edu [1]College of Wooster, Dept of Biology, 931 College Mall, Wooster OH 44691 and [2]Division of Biology, Kansas State University, Manhattan KS 66506.

Much of the land suitable for cultivation in the Midwest has been converted to row-crop agriculture. However, little is known about the use of agricultural land by reptiles. Using geographic information systems (GIS), we examined use of an agricultural landscape by reptiles by investigating the relationship between locations of reptiles, derived from road surveys, and habitat surrounding a road using geographic information systems (GIS). The landscape was composed of agriculture (44%), woodlands (42%), developed lands (10%), river course (3%) and tallgrass prairie (1%). Intensive surveys were conducted along a 10-km stretch of road through this agricultural mosaic from May 2000 to June 2001. We observed 67 individuals of 16 species of reptiles during 2370 km of cumulative road surveying. We found a negative relationship between species richness and the proportion of cropland within 25 m of the road ($R^2 = 0.61$, $P < 0.05$). Richness and total abundance was positively related to the proportion of woodland within 25 m of the road (richness: $R^2 = 0.71$, $P < 0.01$; abundance: $R^2 = 0.80$, $P < 0.01$). Riparian woodlands and other woodlands are important habitats for reptiles in this agricultural landscape. In addition, these habitats likely serve as travel corridors between hibernation sites and summer habitats.

3:45 LIKELIHOOD OF INTESTINAL PARASITE INFECTIONS IN DOGS YOUNGER THAN TWO YEARS. Trina S. McGowan, edntrina@aol.com (Britt A. Bunyard, bbunyard@ursuline.edu) Biology Dept, Ursuline College, 2550 Lander Road, Pepper Pike Ohio 44124.

All dogs are plagued with intestinal parasites at some point in their lives. Puppies are especially susceptible due to the multiple modes of transfer they encounter, (trans-placental, trans-mammary, and from the environment). The goal of this research was to determine the likelihood of intestinal parasite infection in dogs less than two years old. Statistical analyses were run on data collected from 145 fecal samples. Parasite species encountered in the fecal samples included *Isopora canis*, *Toxocara canis*, *Trichuris vulpis*, *Taenia* sp., *Dipylidium caninum* and *Uncinaria stenocephala*. Among the findings of this study were that dogs younger than 3 months were more likely to be infected than older puppies. Also, a dog that had no other dogs in the household was more likely to be infected than those having other dogs nearby.

AQUATIC BIOLOGY I
9:00AM SATURDAY, APRIL 6, 2002
BATTELLE HALL 126
J.G. KOOSER-PRESIDING

9:00 DEVELOPMENT OF A BENTHIC MACROINVERTEBRATE INDEX TO ASSESS BIOLOGICAL INTEGRITY IN THE OHIO RIVER. Jeromy M. Applegate[1], applegate.27@osu.edu Paul C. Baumann[2], baumann.1@osu.edu Erich E. Emery[3], emery@orsanco.org [1]The Ohio State University, School of Natural Resources, 2021 Coffey Rd., Columbus OH 43210, [2]United States Geological Survey and [3]Ohio River Valley Water Sanitation Commission.

The causes of degradation of aquatic systems are often complex and stem from a variety of human influences. Comprehensive, multimetric biological indices have been developed to facilitate the quantification of this degradation and its effect on aquatic communities. Traditionally, indices have concentrated on small to medium-sized

streams. Recently, however, the Ohio River Fish Index (ORFIn) has been created to assess biotic integrity in the Ohio River. The goal of this project is to develop a multimetric index using benthic macroinvertebrates to assess Ohio River biological integrity. Hester-Dendy multiplate samplers were used to evaluate macroinvertebrate community structure in relation to distance downstream of various industrial and municipal wastewater outfalls in the Ohio River. In September 1999 and 2000, samplers were set every 100 meters downstream of the outfalls for 300 to 1000 meters, as well as at an upstream reference site. Metric values (individual measures of community structure) were plotted against distance downstream of each outfall to determine their response to a gradient of human disturbance. Differences at reference and outfall sites were also observed. Over 60 metrics were examined to determine which have potential to detect changes in biotic integrity. Analysis of two years of data has resulted in a selection of potential metrics, including % Diptera composition, number of mayfly individuals, and % tolerant individuals. Background variability in metric values, possibly caused by variables such as flow rates and habitat, as well as quick recovery of metrics downstream of effluent sources, have created difficulties in detecting macroinvertebrate responsiveness to pollution gradients.

9:15 ASSESSING THE EFFECTS OF HIGHWAY CULVERTS ON PRIMARY HEADWATER STREAMS: PRE-CONSTRUCTION FINDINGS. James G. Kooser, jim_kooser@urscorp.com Tracy L. Engle, tracy_engle@urscorp.com Brad M. Falkinburg, brad_falkinburg@urscorp.com and Jeffrey W. Bridgland, jeff_bridgland@urscorp.com URS Corporation, 800 W Saint Clair Ave Ste 500, Cleveland OH 44113-1232.

The Ohio Environmental Protection Agency (OEPA) developed the Headwater Habitat Evaluation Index (HHEI) to assess the habitat quality of primary headwater streams. The HHEI differs from the Qualitative Habitat Evaluation Index (QHEI) used to assess larger streams by assessing habitat for salamanders and macroinvertebrates rather than fish. We began a five-year study to determine how well the method assesses habitat quality, and whether the HHEI can detect habitat degradation as a result of highway construction. We studied six streams in Athens and Meigs Counties; five that will be crossed by a new highway; one that will not be crossed. We identified three sampling zones in each stream, one upstream of each proposed culvert and two downstream (one stream lacked a far downstream zone). Within each sampling zone we established three 10-meter long sampling areas (total number of 10 meter sampling areas = 51). In each sampling area we recorded physical characteristics (bankfull width, flood-prone area, maximum depth, depth of three deepest pools, riffle-run ratio), substrate characteristics (modified Wolman pebble counts and embeddedness), temperature and pH. We collected salamanders and macroinvertebrates using timed searches, and evaluated each stream using the HHEI. During pre-construction sampling we found 541 salamanders representing 4 species, 1,432 macroinvertebrates representing 19 orders, and 86 fish from 3 species. Initial analyses found correlations between the biological data and several habitat variables. The sampling will be repeated in 2006, after highway construction is completed.

9:30 AN ASSESSMENT OF SUBSTRATE EMBEDDEDNESS IN SIX SOUTHEASTERN OHIO PRIMARY HEADWATER STREAMS. Brad M. Falkinburg, brad_falkinburg@urscorp.com James G. Kooser, jim_kooser@urscorp.com Tracy L. Engle, tracy_engle@urscorp.com and Jeffrey W. Bridgland, jeff_bridgland@urscorp.com URS Corporation, 800 W Saint Clair Ave Ste 500, Cleveland OH 44113-1232.

The Ohio Dept of Transportation requested research to evaluate the Ohio Environmental Protection Agencies' Headwaters Habitat Evaluation Index (HHEI) on five primary headwater streams with proposed culvert impacts and one control stream (without impacts) in Athens and Meigs Counties, Ohio. One of the parameters investigated during this study was the percent embeddedness of riffles, runs, glides, and pools in each stream. Embeddedness is the degree to which cobble, gravel, and boulder substrates are surrounded, embedded, or covered by fine materials (sand and silt). The six streams studied were divided into three separate sampling zones, two located downstream and one located upstream of each proposed culvert. Each zone contained three randomly selected, 10-meter long sampling units for a total of nine embeddedness data sets per stream. The embeddedness of riffles, runs, glides, and pools was measured using either a 100 centimeter square sampling frame or a 25 centimeter square sampling frame depending on the width of the stream channel. Each sampling frame was divided into 5 centimeter by 5-centimeter square cells. The sampling frame was randomly placed ten times in each 10-meter long sampling unit. The number of 5 centimeter by 5-centimeter cells with no exposed rocks or pebbles was tallied. The percent of cells with buried substrates (no exposed rocks or pebbles) was calculated and was presented as percent embeddedness. Embeddedness measures were positively correlated with modified Wolman pebble count data. These data will serve as a basis for comparisons when this study is replicated following completion of construction activities.

9:45 CORRELATIONS BETWEEN STREAM BIOTA AND STREAM CLASSIFICATION IN SIX SOUTHEASTERN OHIO PRIMARY HEADWATER STREAMS. Jeffrey W. Bridgland, Jeff_bridgland@urscorp.com James G. Kooser, jim_kooser@urscorp.com Tracy L. Engle, tracy_engle@urscorp.com and Brad M. Falkinburg, brad_falkinburg@urscorp.com URS CORPORATION, 800 W Saint Clair Ave Ste500, Cleveland OH 44113-1232.

A Primary Headwater Habitat (PHWH) Stream Evaluation on six headwater streams in Athens and Meigs County, Ohio was conducted with the objective of evaluating the Headwaters Habitat Evaluation Index (HHEI) designed by the Ohio Environmental Protection Agency. Five primary headwater streams with proposed culvert impacts and one un-impacted control stream were studied. Three field metrics (Stream Channel Substrate, Maximum Pool Depth, and Average Bankfull Width) were collected within a 200-foot section (divided into three zones each) to calculate an HHEI score. The stream was then assigned a class (Class I – ephemeral, seasonal dry; Class II – warm water adapted native fauna; Class III – cool water adapted native fauna). Correlations between macroinvertebrate and salamander populations and stream habitat parameters were sought. Class III streams contained on average 146 individual macroinvertebrates from an average of 10 orders and 41 individual salamanders per sampling zone. Class II streams contained on average 30 macroinvertebrates comprising 4 orders and 19 salamanders per sampling zone. Although average number of individuals was directly proportional to Class ranking, it should be noted that a limiting factor is presence of water. All eight Class III zones had water present while only four of eight Class II zones contained water. Preliminary analysis suggests other habitat variables such as bankfull width, flood prone width, and substrate appear to be less directly related to salamander and invertebrate numbers than the presence of water.

10:00 GENETIC DIVERSITY OF *PHORMIDIUM RETZII* (CYANOBACTERIA) IN A LOW-ORDER WOODLAND STREAM. Dale A. Casamatta, dc274389@ohio.edu and Morgan L. Vis. Dept of Env. and Plant Biology, Ohio University, Athens OH 45701.

This research addresses the genetic diversity of the cosmopolitan cyanobacterium *Phormidium retzii* on a spatial and temporal scale in a headwater stream. Random amplified polymorphic DNA (RAPD) markers were employed to examine genetic similarity of colonies collected from permanent plots along the stream. Eight primers yielded a total of 87 and 90 bands among 29 and 51 samples in 2000 and 2001, respectively. In 2000, distance analysis revealed five major groupings, which were not correlated with sample date or stream location (upstream vs. downstream). Eight of the 10 samples from the final collection date did group together, to the exclusion of all others. Principle Coordinate Analysis (PCO) revealed two clusters, one of which included all of the samples from the last collecting date to the exclusion of others. Analysis of molecular variance (AMOVA) did not show significant differences between upstream and downstream sites, but revealed significant ($p<0.05$) differences in genetic variation among the three sample dates (86 and 14% variance among and within dates). A PCO using 2001 data showed five clusters based primarily on collection date. AMOVA did not show any significant differences in stream locations, but showed significant ($p<0.05$) differences by date (77% variance among dates). One possible reason for the genetic similarity of *P. retzii* mats on the final collection date may be due to the early dates representing cryptic populations from the previous year, while the mats from the later collection dates were from a dominant population upstream with a greater growth rate.

10:15 ALGAL TAXA FROM MONTANE CLOUD FOREST AND ALPINE STREAMS IN BOLIVIA. Amy S. McClintic, am371997@ohiou.edu Dale A. Casamatta and Morgan L. Vis, vis-chia@ohio.edu Ohio University, Dept of Environmental and Plant Biology, Athens OH 45701.

The Andes have been targeted as an important ecosystem for freshwater biodiversity conservation. In spite of this, little is known about algal communities of streams in this region. Macroalgae, microalgae and selected physical and chemical stream parameters were collected from 33 stream segments in Bolivia. Thirteen streams were sampled from the montane cloud forest around Coroico, elevation ca. 1000 m; alpine streams were examined in Unduavi (13 streams) and Sorata (7 streams), elevation ca. 2600-4600 m. At each location, a variety of lotic habitats were examined ranging from rivulets and waterfalls to large trunk rivers. Overall the streams had neutral-alkaline pH (7.4-8.7) with low conductivity (<100 uS/cm) and orthophosphate (<5mg/L). The mean number of macroalgal taxa per stream segment was 2.4 and ranged from 1 to 5. In the 80 specimens collected, a total of 29 macroalgal taxa were identified from the following taxonomic groups: 12 Chlorophyta, 11 Cyanobacteria, 4 Chrysophyta and 2 Rhodophyta. The chlorophyte *Stigeoclonium lubricum* was the most abundant macroalgal taxon in the montane cloud forest streams having been collected in 7 of the 13 streams sampled (54%). The alpine streams were dominated by zygnematacean algae with *Spirogyra* spp. in 8 of the 20 streams (40%) and *Zygnema* spp. and *Mougeotia* spp. in 5 streams (25%). Cyanobacterial taxa were the dominant microalgae identified from montane cloud forest streams. In contrast, taxa of Chlorophyta were the most prevalent microalgal group encountered in the alpine streams. Many of the taxa are new records for Bolivia and South America.

10:30 MACROALGAE OF THE HAWAIIAN ISLANDS: 23 ADDITIONAL STREAM SEGMENTS. Nanda R. Filkin[1], nf160798@ohio.edu and Alison R. Sherwood[2] and Morgan L. Vis[1], [1]Dept of Environmental and Plant Biology, Ohio University, Athens OH 45701, [2]Dept of Botany, University of Hawaii (Manoa).

The Hawaiian Islands are located 3700 km from the nearest continental land mass and as such provide an interesting research opportunity to study freshwater organisms intolerant of seawater. The freshwater biota has been only partially studied with little research on the stream macroalgae. The only previous study, which focused solely on stream macroalgae, reported 25 new species to the Hawaiian Islands from 34 stream segments sampled. The purpose of our study was to expand the sampling of streams to better determine macroalgal distributions and species richness. Twenty-three additional stream segments (7 on Oahu, 8 on Kauai and 8 on Hawaii) were sampled for macroalgae. The physical and chemical parameters of each stream were measured. Stream segments ranged greatly in size from 1.2 m to 40 m in width. Water temperature was relatively uniform (ca. 21°C) but other chemical parameters differed from site to site (pH 5.5-8.9, specific conductance 20-200 µS/cm). Mean species richness per stream segment was 4.2 with two to seven species collected per segment. To date, 21 infrageneric taxa have been identified from the Chlorophyta (8), Cyanobacteria (7), Rhodophyta (5) and Chrysophyta (1). The most abundant taxa were *Cladophora glomerata*, *Compsopogon coeruleus* and *Phormidium retzii*. All three of these species are cosmopolitan. Seven of the taxa are new records for streams in the Hawaiian Islands. The large percentage (33%) of new taxa suggests that more research such as this study needs to be conducted to fully catalog the Hawaiian stream macroalgal diversity.

10:45 PRELIMINARY REPORT ON SOME FRESHWATER ALGAE OF ECUADOR. Susan Carty, scarty@heidleberg.edu and John D. Hall II, jhall2@heidelberg.edu Dept of Biology, Heidelberg College, Tiffin OH 44883.
The freshwater flora of Ecuador is poorly known. This report provides preliminary information about the freshwater Pyrrhophyta and two families in the Chlorophyta. There has been some work on diatoms but other groups remain unstudied. In June 2001 samples were collected as whole water or by using a 10 µm plankton net from 52 locations in the interior (Amazonian) and Andean regions and examined within hours using a Swift field microscope. Nine additional samples from Ecuador have been provided by Dr. Miriam Kannan. Amazonian sites consisted of oxbow lakes along the Rio Shiripuno, and small ponds and lakes along the road from the river to Coca. Andean sites were principally in the Cajas National Park near Cuenca. Genera in the Scenedesmaceae include *Scenedesmus* and *Coelastrum*, genera in the Desmidiaceae include *Micrasterias*, *Desmidium*, *Cosmarium*, *Gonatozygon*, *Bambusina*, *Pleurotaenium*, *Staurastrum*, *Arthrodesmus*, *Xanthidium*, and *Closterium*. Pyrrhophyta include *Gymnodinium*, *Sphaerodinium*, *Peridinium*, and *Hemidinium*.

Aquatic Biology II
2:00PM Saturday, April 6, 2002
Battelle Hall 126
Robert Klips-Presiding

2:00 IMPACTS OF COLIFORM BACTERIA AND LIMESTONE SEDIMENT ON *ORCONECTES INERMIS INERMIS* (DECAPODA: CAMBARIDAE) IN PLESS CAVE, LAWRENCE COUNTY, IN. Matthew C. Hazelton, s02.mhazelton@wittenberg.edu (Horton H. Hobbs III hhobbs@wittenberg.edu) Dept of Biology, PO Box 720, Wittenberg University, Springfield OH 45501-0720.
The impact of coliform bacteria and limestone sediment pollution on the aquatic ecology of Pless Cave (Lawrence County, IN) was explored by examining the relative abundance of blind crayfish, *Orconectes inermis inermis*. Specific conductance, water hardness, pH, and temperature were measured to detect possible negative effects of the pollutants. Because *O. i. inermis* is the climax species of Pless Cave's aquatic ecosystem it can be used as an accurate indicator of ecological health. Twelve data sets, composed of physicochemical and biological information, will be collected with six having been accumulated to date. This will provide an accurate year-round portrayal of the ecology of Pless Cave. Results to date suggest that neither the limestone sediment nor the coliform bacteria are having major negative impacts on the Pless Cave ecosystem. Two gasoline spills in the 1980s severely impacted the Pless Cave community based on comparisons of current data with those of the early 1970's. No post-spill crayfish population data are available to compare with data from this study.

2:15 A NEW METHOD FOR STUDYING NUTRIENT LIMITATION OF PERIPHYTON. Sarah E. Hamsher[1], sh331301@ohiou.edu Dale A. Casamatta[1], Nanda R. Filkin[1], Amy S. McClintic[1], Wayne B. Chiasson[1], Robert G. Verb[2], and Morgan L. Vis[1], [1]Dept of Environmental and Plant Biology, Ohio University, Athens OH 45701 and [2]Dept of Biology, Ohio Northern University, Ada OH 45810.
Acid mine drainage impacts ca. 16,900 km of streams in the Appalachian region, but little is known about the biology of these habitats. Numerous studies have been conducted employing terracotta pots to assess periphyton nutrient limitation. Recently, research has concluded that this methodology may have inherent flaws due to variable porosity. Therefore, development of new nutrient diffusing substrates is needed. To test a new approach for nutrient diffusion, petri dishes were filled with agar and the nutrient of choice. A Whatman glass microfiber filter (GF/F) was attached to the top of the dish, which served as the medium through which the nutrients diffused and as a uniform surface area for periphyton colonization. Before testing in a stream impacted by acid mine drainage, laboratory studies were conducted to simulate field conditions. Nine containers were filled with 1.0 L acidified (pH 3) distilled water, which was circulated via individual stir plates. Diffusing petri dishes with either 0.5 M nitrate or phosphorus were placed into the containers. Water was saturated with nutrients within a few days and thus was changed every other day for the first few weeks. After one week the nitrate concentration in the experimental study approximated ambient local stream water concentrations. However, the phosphorus concentration (0.76 mg/L) remained 10 fold higher (0.076 mg/L) than that found in the streams of interest. This laboratory study suggests that a phosphorus concentration of 0.5 M is suitable for long-term field studies but that the nitrate concentration may need to be increased. Seasonal assessment of this approach is currently underway employing *in situ* experiments.

2:30 A CONSTRUCTED WETLAND TREATMENT SYSTEM DESIGNED FOR ACCOMMODATION OF BOTH HIGH NUTRIENT NURSERY PAD EFFLUENT AND AGRICULTURE STORMWATER RUNOFF. Becky E. Lippmann, lippmann.3@osu.edu Environmental Science Graduate Program, Ohio State University, 210 Kottman Hall, 2021 Coffey Rd, Columbus OH 43210 (Dr. Virginie Bouchard, bouchard.8@osu.edu) Dr. Martin Quigley quigley.30@osu.edu Dr. Jay Martin, martin.1130@osu.edu Dr. Tim Granata, granata.6@osu.edu Dr. Larry Brown, brown.59@osu.edu
Constructed wetlands have been developed for two main reasons: to substitute function for a natural wetland that was lost or removed, or to enable watershed managers to reduce or remove toxic or harmful substances from drainages. Many agricultural constructed wetlands are designed to ameliorate impacts of stressful environmental inputs, such as high nitrogen concentrations, chemical pollution and sediment. Urban "detention ponds" are usually designed to slow runoff and to filter petrochemical pollutants, but not sediments. This study focuses on the potential for treating multiple land-use inputs within a single wetland system. A double basin constructed wetland treatment system (CWTS) has been constructed on the OSU Waterman Farm to test the treatment of a consistently high nutrient influent—a nursery container production pad—while providing sufficient retention of periodic storm water runoff from agricultural drainages. Nutrient and suspended sediment concentrations will be quantified at several points in the CWTS. Random soil samples will be tested periodically for bulk density, percent carbon and methane, carbon dioxide and denitrification potentials. Plant community structure (LAI, biomass, species composition) and sediment dynamics will indicate water treatment performance. Initial results include bulk density range between 1.18-1.98 g/cm^3 and LAI range between 0.04-0.44. It is hypothesized that from the inlet to the outlet of each wetland cell, plant density will decrease, species diversity will increase and sediment deposition and pollutant level will decrease. This CWTS was created to explore minimization of costs and land requirements for agricultural wetlands, and to demonstrate a method for zero-discharge farming practice.

2:45 EFFECT OF ENVIRONMENTAL STRESS ON SOIL NEMATODE LIFE HISTORY CHARACTERISTICS Andrew J. Hosken, ahosken@hotmail.com 15750 Ida Center Rd, Petersburg MI 49270 and Deborah A. Neher, deborah.neher@utoledo.edu Dept of Earth, Ecological and Environmental Sciences, University of Toledo.
Nematodes are found in ecosystems ranging from tropical rainforest to arctic tundra. Indices of nematode community structure and composition such as species richness, trophic structure, and successional status are useful in monitoring soil health. Index values decrease in soils contaminated with heavy metals. The goal was to confirm life history traits of Rhabditidae, a group of nematodes generally believed to tolerate heavy metal contamination. This family is assigned a rank of 1 in Bonger's maturity index, on a scale of 1 to 5, with 1 being most tolerant and 5 most sensitive to environmental stress. *Acrobeloides* and *Rhabditis*, two genera of Rhabditidae, were extracted from two soil sites, cultivated in petri dishes containing Nematode Growth Medium, and fed *Escherichia coli* OP50. The nematodes were then subjected to different metals that were mixed into the medium. Their survivorship and reproduction were measured. Both genera are closely related but respond very differently to stress, and this sensitivity increased with duration of time in culture. Those taken from contaminated soil lost their tolerance to the same soil contaminants; those taken from uncontaminated soil also exhibited lower tolerances to stress. This suggests that current techniques used for ecotoxicological testing of nematodes should consider the possibility of rapid loss of tolerance in culture.

3:00 INDUCED HIGH TEMPERATURE HARDINESS WITHIN THE COLLEMBOLAN *SINELLA CURVISETA*. Kimberly D. Sturgis, Kimmie10@aol.com Richard L. Stewart JR, Stephen J. Diakoff. Malone College, Dept of Natural Science, 515 25th ST NW, Canton OH 44709.
Sinella curviseta, Insecta: Collembola, are abundant, widespread insects. Members of this order display a wide range of temperature tolerance that enables them to survive

anywhere on Earth. Our experimentation has revealed this species' higher lethal temperature limits. These springtails were reared continually at approximately 23°C with twelve-hour light-dark cycles and 100% relative humidity. They were transferred from their normal rearing chambers into test tubes and exposed to temperatures ranging from 26°C to 40°C within incubators. Their higher lethal temperature (HLT) was discovered at 39°C at 53% relative humidity after a two-hour exposure. *Sinella curviseta* were subsequently pre-exposed at a lower stressor temperature, 37.5°C with 53% relative humidity, for two hours. They were then placed back into their normal rearing conditions for approximately twenty-four hours and then re-exposed at, or above, the unexposed HLT. Altered responses were demonstrated, including survivorship of the pre-exposed group above their HLT. We speculate that a protein is being expressed by *Sinella curviseta* while it is exposed to the stressor temperature or during its recovery period. This may convey increased hardiness above their unexposed HLT. We predict that longer pre-exposure times at lower stressor temperatures will provide an increase of survivorship at their unexposed HLT.

3:15 BIODIVERSITY AND ECOLOGY OF MYCOPHAGOUS DIPTERA IN NORTHEAST OHIO. Britt A. Bunyard, bbunyard@ursuline.edu Ursuline College, Biology Dept, Dauby Science Center, Pepper Pike OH 44124.
Despite their ubiquity in nature, few studies have been conducted worldwide to determine the ecological importance of mycetophagous diptera (fungi-feeding flies). For this study 134 species from 30 families of Basidiomycetous fungi and 19 species from 11 families of Ascomycetous fungi were collected from different sites in Northeastern Ohio (Cuyahoga, Geauga, and Portage Counties). Many fungal species were collected on different dates throughout the growing season (March–November, 2001). Different sites were selected to obtain a diversity of mushroom substrate, as well as biotic and abiotic conditions, and consisted of mature forest, mixed mesophytic forest, urban forest, and urban residential. Adult flies were reared from 87 different fungal collections (basidiocarps or ascocarps = "mushrooms"). Families of diptera that seem to include mycophagous species are: Drosophilidae, Chloropidae, Phoridae, Mycetophilidae, Sciaridae, Tipulidae, Cecidomyiidae, and Platypezidae. Several other dipteran families are probably scavengers (Anthomyiidae, Sarcophagidae), occurring only infrequently in decaying mushrooms. Many mycetophagous flies are poorly known; several have larval stages that remain completely undocumented. While some fungal species seem to host a single fly species per mushroom, most do not. The two most commonly seen fly species were *Drosophila falleni* and *Leucophenga varia*, both of the family Drosophilidae. These two species commonly co-inhabit basidiocarps; occasionally with two other less common drosophilids: *Mycodrosophila claytonae* and *D. tripunctata*. How these species can avoid competition is uncertain, though preliminary evidence suggests parasitism by species of parasitic wasps and predation by ants and beetles may play a role.

3:30 GENETIC VARIABILITY AND PHYLOGEOGRAPHIC PATTERNS OF A NONINDIGENOUS SPECIES INVASION: A COMPARISON OF EXOTIC VERSUS NATIVE ZEBRA AND QUAGGA MUSSEL POPULATIONS. Kora A. Dabrowska, kad12@po.cwru.edu Great Lakes Genetics Laboratory, Cleveland State University, MC-219, 1899 E 22nd St, Cleveland OH 44114-4435. Clifford D. Taylor. Carol A. Stepien, c.stepien@csuohio.edu
There have been few investigations of the number of founding sources and amount of genetic variability that lead to a successful invasion of nonindigenous species, although genetic diversity is believed to play a central role. In this study, population genetic structure, diversity, and divergence patterns were analyzed for the zebra mussel, *Dreissena polymorpha* (N=280 samples and 63 putative RAPDs randomly amplified polymorphic DNA gene loci), and the quagga mussel, *D. bugensis* (N=136 and 52 loci), from ten nonindigenous North American and six Eurasian sampling sites, representing their present-day ranges. Results showed that exotic populations of zebra and quagga mussels had surprisingly high genetic variability, similar to those in the Eurasian populations, suggesting large numbers of founding individuals and consistent with the hypothesis of multiple colonizations. Patterns of genetic relationships indicate that the North American populations of *D. polymorpha* likely were founded by multiple source populations from northwestern and north central Europe, but not from south central or Eastern Europe. Sampling areas within North America also were significantly divergent (with the largest differences between Lake Superior versus the St. Lawrence River, and between the Mississippi and St. Lawrence Rivers), having levels of gene flow and migration about twice that separating long-established Eurasian populations. Samples of *D. bugensis* in Lakes Erie and Ontario were significantly different, with the former being more closely related to a native population from the Dnieper River, Ukraine. No evidence for a founder effect was discerned for either species.

3:45 PHYLOGEOGRAPHY OF *BATRACHOSPERMUM HELMINTHOSUM* (RHODOPHYTA) IN NORTH AMERICA. Wayne B. Chiasson, chiasson@ohiou.edu Nicholas J. Machesky and Morgan L. Vis, vis-chia@ohio.edu Ohio University, Dept of Environmental and Plant Biology, Athens OH 45701.
The freshwater red alga, *Batrachospermum helminthosum*, is distributed primarily in streams of eastern North America. Although it is often an abundant and conspicuous component of the algal flora for many streams, little is known about the genetic relationship among populations throughout its range. The purpose of our study was to elucidate geographic patterns among populations to gain insight into the biogeographic distribution of this species and possible modes of dispersal. Individuals were sampled in 13 stream segments as follows: four locations in Ohio, two locations in Michigan and one location each in Indiana, North Carolina, Tennessee, Louisiana, Rhode Island, Massachusetts and Connecticut. The mitochondrial spacer region (372bp) between the COX2 and COX3 genes was chosen because it is variable among individuals. This region was sequenced for 15-20 individuals from each location. Fourteen haplotypes were identified among the 13 locations with most locations having only one haplotype. Two haplotypes were present in three of the Ohio stream segments but these populations differed in the frequency of each haplotype. Interestingly, the other Ohio and North Carolina populations had only the first haplotype whereas Connecticut and Rhode Island only showed the second haplotype. The Indiana, Louisiana and Michigan populations each had a unique haplotype. The Tennessee population had 3 haplotypes, one of which was very similar to the Michigan haplotype. The relationships among these populations are very complex but there may have been a recent dispersal event or gene flow among the Ohio populations and those in Massachusetts, Rhode Island and North Carolina.

4:00 HIBISCUS FLOWERS IN AN OHIO WETLAND SUPPORT A DIVERSE ASSEMBLAGE OF INSECTS. Robert A Klips[1], klips.1@osu.edu George D. Keeney[2], keeney.1@osu.edu [1]The Ohio State University at Marion, Dept of Evolution, Ecology, and Organismal Biology, 1465 Mt. Vernon Ave., Marion OH 43302, and [2]The Ohio State University, Dept of Entomology, 1735 Neil Ave., Columbus OH 43210.
The common rose mallow, *Hibiscus moscheutos*, is an herbaceous perennial marsh herb bearing large flowers that produce copious amounts of nectar, pollen, and shelter exploited by a community of insects. During the entire flowering period spanning late July through mid-September 2001, a mallow population at Stages Pond State Nature Preserve (Pickaway County, Ohio) was visited during mid-afternoons at 5-day intervals. All arthropods occurring on 10 haphazardly selected flowers were sampled, counted, and identified. Common insects include several detrimental to the plant such as the generalist flower-feeding Japanese beetle (*Popillia japonica*), a specialist weevil (*Conotrachelus fissunguis*) that feeds on the flowers as adults and on the fruits as larvae, and two bruchid seed beetles (*Althaeus* spp.). One of the bruchids, *A. hibisci*, although apparently rare in Ohio, was much more common than the very similar *A. folkersti*. Male-biased bruchid sex ratios (2.6 male:1 female) were noted early in the season (26 July), possibly as females frequented young fruits to oviposit there. Beneficial and commensal flower associates are the specialist anthophorid "hibiscus bee" bee *Ptilothrix bombiformis* that provisions her nest with balls of pollen, and a sap beetle (*Conotelus obscurus*). Seasonal changes in insect species occurrence were noted, as bruchid density (beetles per flower) dipped mid-season in apparent inverse relation to the total number of blossoms. The bruchid *A. folkersti* was encountered only during the first two sample dates (26 July and 31 July), while the sap beetle and a pomace fly (*Drosophila* sp.) were common later.

4:15 IMPACT OF MACROPHYTE FUNCTIONAL DIVERSITY ON PRIMARY PRODUCTIVITY AND METHANE PRODUCTION IN WETLANDS. Sharon E. Reed, reed.516@osu.edu Ohio State University, 210 Kottman Hall, 2021 Coffey Rd, Columbus OH 43210, Virginie Bouchard bouchard.8@osu.edu and Serita Frey frey.77@osu.edu
The studies objective was to determine the impact of plant functional group diversity on primary productivity and methane production in wetlands. It was hypothesized that a shift in macrophyte functional diversity would significantly increase methane fluxes due to changes in the quantity of plant biomass inputs. This hypothesis was tested with mesocosms in which the number of macrophyte functional groups was manipulated (i.e., 1 to 5 functional group per mesocosm; 6 replicates). Functional groups were clonal dominants, reeds, tussocks, obligate annuals, and facultative annuals. Belowground methane production (n=4) was measured with in-situ samplers installed at three depths and aboveground gas emission (n=6) was sampled using plexiglass chambers. Aboveground and belowground plant biomass was harvested in September 2001 to estimate net primary productivity. Statistical analysis will use SASS software™ Aboveground productivity in mesocosms with five and four functional groups (529± 88 g and 510±102 g, respectively) was higher than aboveground productivity of mesocosms with 3 and 4 functional groups (392±78 g and 345±69 g, respectively). Monocultures with fast growing plants had aboveground productivity similar to the higher diversity treatments (527±131g, clonal dominants). Monocultures of reeds, tussocks, and facultative annuals had lower aboveground productivity than all diversity combinations. Belowground productivity was lower in mesocosms with higher diversity (22.9± 4.6g) than in those containing only clonal dominant species (62.5±15.6g). Monocultures of reeds, tussocks, and facultative annuals had lower belowground productivity than diversity treatments (21.2±5.3g-1.50±0.38g). Aboveground methane emissions in controls (77.54ppm±66.3) were greater than monocultures and diversity treatments.

4:30 THE EFFECTS OF SALT MARSH HAYING ON BENTHIC ALGAL BIOMASS. Libby A Williams, williala@acs.wooster.edu (Kimberly N Russell krussell@acs.wooster.edu) The College of Wooster, C-3006 1189 Beall Ave, Wooster OH 44691.

Salt marsh haying (the removal of above-ground vegetation with a tractor) is a traditional activity on East Coast salt marshes and is still carried out throughout Plum Island Sound, located in northeastern Massachusetts. The removal of approximately 90% of the aboveground biomass of the salt marsh by haying may alter many ecological processes within the salt marsh. One such process is the production of benthic algae. There should be a marked increase in benthic algal biomass after an area has been hayed because the benthic algae are no longer limited by available light. Sediment core samples were taken at three marsh sites, each about 1 to 2 hectares in area. Two sites are regularly hayed (EPH and HAY), and one is an unhayed reference site (PUH). At PUH and EPH, six 1-m^2 quadrats were placed randomly in two different vegetation zones, *Spartina alterniflora* and *Spartina patens*. Three quadrats in each vegetation zone at each area were cleared of aboveground vegetation using hedge clippers, and three were left unclipped as reference quadrats. At HAY, three 1-m^2 quadrats were established within *Spartina patens* zones after haying. Six sediment cores (3-cm in diameter, 1-cm depth) were taken from each quadrat at day 0, day 7, day 14 and day 30 after clipping (or haying). The benthic chlorophyll was extracted from the core samples using 90% acetone and absorbance readings were measured on a spectrophotometer at two wavelengths, 750 nm and 650 nm. The measurements of benthic chlorophyll a were utilized as an estimation of the algal biomass present. We found that although there was a significant difference in algal biomass between hayed and unhayed sites (ANOVA, $P>0.05$), clipping appeared to have no significant affect on algal biomass (ANOVA, $P<0.05$). We suspect that haying on a large scale, but not small-scale removal of the plant canopy, increases the amount of benthic algae present.

4:45 VANCOMYCIN RESISTANT ENTROCOCCI IN STREAMS OF WAYNE COUNTY, OHIO. Lori M. Mitskavich, mitskalm@acs.wooster.edu (Dean Fraga, dfraga@acs.wooster.edu Raymond Matlack, rmatlack@acs.wooster.edu) College of Wooster, Dept of Biology, 1189 Beall Ave., Wooster OH 44691-2363.
Agricultural antibiotic use, particularly use of the antibiotic vancomycin in animal husbandry practices, may have an effect on the amount of vancomycin resistant enterococci (VRE) found in streams surrounding these farms Vancomycin is commonly called the drug of last resort because it is often the only antibiotic to which some pathogens remain sensitive. If VRE from contaminated water were to get inside the intestinal tract of humans, the bacteria could potentially spread their antibiotic resistance genes to other intestinal bacteria, therefore rendering vancomycin useless. It is hypothesized that the probability of occurrence of VRE will increase with an increase in antibiotic use in animal feed on farms. Water samples were collected from October through December 2001 from 103 randomly selected sites in 31 watersheds in Wayne County Ohio. Each sample was filtered using a cellulose nitrate membrane and plated on mEnterococcus agar. Enterococci colonies were then plated on Brain Heart Infusion agar supplemented with 6µg/ml vancomycin to select for vancomycin resistant enterococci (VRE). Sampling found 72% of the 103 samples showed the presence of VRE. Among those plates there is variation in the amount of VRE present, ranging from 1 to 29 colonies. By the conclusion of my project, I hope to be able to predict the occurrence of VRE by examining land use in the watershed. This model can then be used to create a predictive map of Wayne County that indicates the probability of finding VRE within a stream for the sampling period of fall, 2001, by using geographical information systems.

MOLECULAR BIOLOGY
9:00 AM SATURDAY, APRIL 6, 2002
BATTELLE HALL 144
DANIEL J. KASER-PRESIDING

9:00 NITRIC OXIDE AND ENDOTHELIAL NITRIC OXIDE SYNTHASE MAY PRODUCE A HYPOTENSIVE EFFECT IN A LOW BLOOD PRESSURE LINE OF WISTAR-KYOTO (WKY) RAT. Colin M. Everhart, (Daniel L. Ely, ely1@uakron.edu) Dept. of Biology, University of Akron, Akron OH 44325-3908.
The hypothesis tested was that a greater amount of endothelial nitric oxide synthase (eNOS) protein and nitric oxide (NO) will be produced in the WKY/Low blood pressure (LBP) strain than in both the WKY/Normal blood pressure (NBP) and Spontaneously Hypertensive Rat (SHR) strains (n=8/group). Blood pressure (BP) was measured by a tail-cuff method and recorded at 12 and 20 weeks of age and correlated to NO and eNOS levels. Aortas, hearts, and livers were removed and frozen at -70°C. Tissues were homogenized and examined by Western Blot for levels of eNOS activity. Urine (24 hour) was collected from the animals and examined by a gas-phase chemiluminescence's detection technique to determine total NO output. The mean BP for WKY/LBP was 115±2 mmHg, WKY/NBP was 127±4 mmHg, SHR was 162 ±5 mmHg. The mean NO output for the WKY/LBP was 62±30 µmol/day NO_3^-, WKY/NBP was 29±20 µmol/day NO_3^-, SHR was 7±7 µmol/day NO_3^-. The relationship between BP and NO output between SHR and WKY/LBP was statistically significant ($p<0.001$, $r^2=0.43$). This suggests that NO production may produce a hypotensive effect in a LBP line of WKY rats.

9:15 EFFECTS OF A MIXTURE OF TWO SPECIFIC PCB MOLECULES ON GENERAL DEVELOPMENT, THYROID STATUS, AND A NEUROCHEMICAL MEASURE IN 15-DAY OLD SPRAGUE-DAWLEY RATS. Chelsea S. Combs, combs_chels@yahoo.com Michelle J. Meadows, Katherine Kusnyer, Terri Provost, Christa Bowen, and Lee A. Meserve. Bowling Green State University, 217 Life Science Building, Bowling Green OH 43403-0212.
Polychlorinated biphenyls (PCB) were used in industry for over 30 years. Although their manufacture and use has been prohibited for the last 20 years, lipophilic and stable natures of PCB continues to result in its bioconcentration in the fatty tissues of animals and humans. Depending on the amount of chlorine, there are 209 possible forms (congeners) of PCB molecules. Thyroid hormone (TH) status is a target for endocrine-disrupting effects of PCB, so developmental and neurochemical alterations result from ingestion. The present study examined effects of a mixture of PCB 47 (minimally thyroid disruptive) and PCB 77 (thyroid disruptive) on developmental, hormonal, and neurochemical measures in 15-day old Sprague-Dawley rats (*Rattus norvegicus*). Dams were continuously fed a control diet, 1.25 ppm, 12.5 ppm, or 25.0 ppm of PCB 47/77 from gestational day 1, and sacrificed on postnatal day 15. Ingestion of PCB 47/77 significantly increased liver weights and decreased spleen weights, indicating the widespread effects of this toxicant. PCB 47/77 significantly depressed levels of both T_4 and T_3 with pronounced effects on T_4 levels. Choline acetyltransferase activity was elevated in basal forebrain and hippocampus. Thus, exposure of 15-day old rats to PCB 47/77 reduced body weights, altered organ weights, depressed thyroid hormone levels, and elevated ChAT activity, suggesting that PCB 47/77 disrupts thyroid status and other developmental measures, and inappropriately enhances ChAT activity. This enhancement may relate to increased incidence of behavioral alterations in human populations ingesting PCB.

9:30 THE MECHANISM OF CASODEX-INDUCED CELL DEATH? Rachel A. Schallhorn, rschallh@capital Dept. of Biology, Capital University, 2199 E. Main St., Columbus OH 43209-2394.
Prostate cancer is the second leading cause of cancer related death for men in the United States. Anti-androgens such as Casodex® are a widely used form of treatment. Patients treated with anti-androgens ultimately become resistant to the drug and develop hormone refractory tumors. Studies have shown a positive correlation between increased levels of Bcl-2, a protein involved in the regulation of the mitochondrial apoptotic pathway, and prostate cancer progression. Two sublines of LNCaP non-invasive human prostate cancer cells over-expressing Bcl-2 were treated with varying concentrations of tumor necrosis factor α (TNF-α) and Casodex®. Crystal violet assays were used to determine relative viability and MTT assays to determine the relative mitochondrial activity. Western blot analyses were run to determine the androgen receptor status of the Bcl-2 over-expressing cells. The Bcl-2 over-expressing cell lines treated with TNF-α had a significantly lower amount of death than the wild-type cell line. Treatment with Casodex® resulted in similar amounts of death in each of the three cell lines. Western blots showed androgen receptors were absent in the nuclei of the cells treated with Casodex®. These results indicate over-expression of Bcl-2 protects LNCaP cells against death from TNF-α but not from Casodex®. Therefore, the mechanism by which Casodex® induces death in LNCaP cells prevents androgen receptors from entering the nucleus and is unaffected by Bcl-2 levels.

9:45 VALIDATION OF DIFFERENTIAL GENE EXPRESSION IN NF1-MUTANT SCHWANN CELLS USING REAL-TIME, QUANTITATIVE RT-PCR. John F. Vitullo, jvitullo@capital.edu Dept. of Biology, Capital University, 2199 E. Main St., Columbus OH 43209-2594.
NF1 is an acronym for the gene responsible for Neurofibromatosis type 1, an inherited disorder that often results in permanent physical and mental impairment to those afflicted. Patients with NF1 have a predisposition to developing a variety of benign and malignant tumors, many of which affect the peripheral and central nervous systems (PNS and CNS). NF1 patients can also exhibit cognitive deficits and many other manifestations unrelated to cancer, usually affecting neural-crest derived tissues outside of the PNS. This seems to indicate that the NF1 gene is important to growth control and developmental functions in a wide range of cell and tissue types. Schwann cells are the major cell population in benign neurofibromas, tumors that disfigure human patients with NF1. It is not yet known how molecular abnormalities in neurofibroma Schwann cells contribute to tumor formation. By increasing our understanding of this tumor development through molecular genetic and other cell biological approaches, we should begin to see an integrated picture of the normal role of NF1. The objective of my study was to confirm differential expression of several select genes identified in a cDNA microarray analysis. Quantitative, real-time RT-PCR was utilized to assess the relative gene expression of Schwann cell cDNA in normal wild-type mice as compared to transformed NF1-mutant mice. Quantitative analysis confirmed differential expression in eight genes. However, the magnitude of these changes showed marked variation. Seven of the eight genes showed a positive correlation to our microarray expression data, thus confirming our data for those genes.

10:00 DISSECTION OF MEMBRANE TARGETING MECHANISMS FOR CYTOPLASMIC DYNEIN Albert E. Chaffin, achaffin@capital.edu Capital University,

and Kevin T. Vaughan, Kevin.T.Vaughan.4@nd.edu University of Notre Dame, Dept. of Biology, Notre Dame IN 46556.
Cytoplasmic dynein (CD) is a microtubule motor protein responsible for multiple aspects of membrane transport and chromosomal segregation during mitosis. The Vaughan Laboratory at the University of Notre Dame is interested in mechanisms that cytoplasmic dynein uses to bind cargo. Several subunits have been implicated in mediating organelle binding, including the intermediate chains (ICs), light intermediate chains (LICs) and light chains (LCs). We have focused on the ICs because previous studies revealed that they interact with the p150^{Glued} subunit of dynactin and that this interaction is regulated *via* IC phosphorylation at serine-84. To determine the impact of IC phosphorylation, site-directed mutants that mimic either phosphorylated (S84D) or dephosphorylated (S84A) IC-2C were transfected into COS-7 cells and tested for membrane transport defects. S84A mutants perturbed dynein-mediated transport by competing with intact dynein for organelle binding. In contrast, S84D mutants failed to compete with dynein for organelle binding or disrupt dynein-mediated transport. Because previous studies had been performed using full-length ICs, which can associate with the dynein LC subunits, we prepared truncated ICs that lack LC-binding sites and tested for organelle transport defects by transfection. The results using truncated ICs were different from results gathered using full-length ICs, with the S84A mutants displaying less disruption of dynein-mediated transport, and S84D mutants displaying more disruption. Although further work will be needed to clarify these observations, these findings suggest that the N-terminus of the ICs and interacting proteins could contribute to organelle binding.

10:15 SUBCLONING OF THE LEUKOCYTE ANTIGEN RELATED GENE INTO A BACTERIAL EXPRESSION PLASMI D. Albert E. Chaffin, achaffin@capital.edu Jens Hemmingsen, jhemming@capital.edu Capital University, Dept. of Chemistry, Columbus OH 43209-2394.
Enzyme-catalyzed phosphorylation and dephosphorylation of tyrosine residues act as regulatory mechanisms in many intracellular signal transduction pathways. In Humans, domain 1 of the Leukocyte Antigen Related Protein (LAR-D1) is a tyrosine phosphatase involved in cell growth regulation. The LAR-D1 gene has been subcloned into the plasmid pSTBlue-1 for blue white colony screening. When cultured, subcloned *Eschericia coli* colonies were white. This suggests that LAR-D1 was inserted into pSTBlue-1. Having isolated the LAR-D1 gene into the screening plasmid, pSTBlue-1, we then subcloned the gene into an expression plasmid. This will allow us to collect ample amounts of the LAR-D1 protein to use for enzyme kinetic studies. To achieve this next step, we attempted to ligate LAR-D1 into the plasmid pGEX-4T-1 as a fusion to Glutathione-S-transferase. This allows expression of the LAR-D1 protein in *Eschericia coli* bacteria and makes collecting the protein easier. LAR-D1 has been successfully subcloned into pGEX-4T-1 according to restriction digest mapping. However, successful cloning will be confirmed by DNA sequence analysis and protein electrophoresis. Once we have isolated the enzyme, future studies will focus on the enzymology and inhibition of LAR-D1. By studying the chemical interactions of this protein, possibilities arise to develop inhibitors to treat disorders such as cancer, diabetes, immune and other diseases.

10:30 DEVELOPMENT OF OPIOID RECEPTORS IN THE CHICK AUDITORY BRAINSTEM. Erika N. Oleson, olesonerika@hotmail.com (Kerry Cheesman, Ph.D. kcheesman@capital.edu) Capital University, 2199 E Main St, Columbus OH 43209.
Opioid receptors are located in the nucleus magnocellularis, an element of the auditory brainstem, of the chick species *Gallus domesticus*. Traditionally found in the somatosensory system, the receptors are now believed to be located in additional sensory systems. The aim of this study is to determine the location of the kappa, delta, and mu-opioid receptors within the nucleus magnocellularis of the auditory brainstem. The study will follow the development of each opioid receptor from embryonic age 11 days to post-hatch age 23 days. Standard immunohistochemical procedures are performed on each auditory brainstem tissue and then stained. Initial results indicate that the kappa-opioid receptor is found in the cytoplasm of the nucleus magnocellularis. Mu-opioid receptors have been found in the nucleus of embryonic age 11 days chicks. At post-hatch age 7 days the staining transitions into the nucleus and cytoplasm, continuing through post-hatch age 23 days. Delta-opioid receptors give a general amorphous stain, indicating that they may not be present in the nucleus magnocellularis.

10:45 CHARACTERIZATION OF ADRENAL NICOTINIC RECEPTOR SUB-POPULATIONS USING [^{3}H]EBIPATIDINE BINDING AND PROTECTION ASSAYS. Daniel J. Kaser, kaser.22@osu.edu (Dennis B. McKay, Ph.D., mckay.2@osu.edu) The Ohio State University, Division of Pharmacology, 500 W 12th Ave, Columbus OH 43210.
Neuronal nicotinic acetylcholine receptors (nAChRs) are ligand-gated ion channels that pervade the central and peripheral nervous systems and are implicated in several neurological disorders such as Alzheimer's Disease, Parkinson's Disease, and schizophrenia. Multiple nAChR subtypes exist, each with a distinct pharmacological and functional profile. The hypothesis is that bovine adrenal chromaffin cells express multiple subtypes that can be identified using receptor protection assays. Exposure to subtype-specific compounds prevents irreversible inactivation of the reduced binding site via alkylation with bromoacetylcholine. By protecting certain subtypes from alkylation, it is then possible to perform radiolabeled binding assays to pharmacologically characterize this population. Our laboratory has demonstrated the utility of antagonist protectants on cultured chromaffin cells; the studies documented here, however, involve the use of a membrane preparation. Unlike an intact cell system, agonistic desensitization does not occur in homogenate tissue, allowing a broader scope of drugs to be examined. Specific binding of [^{3}H]epibatidine to the adrenal membrane preparation reaches equilibrium within 30 min at room temperature, and saturation binding fits a model for a single site with a Hill coefficient close to 1. Initial results demonstrate that alkylation eliminates binding within 5%, and a reduction followed by reoxidation control group can yield a recovery of binding above 90%. Two agonists, nicotine and carbachol, offer near complete protection from alkylation, consistent with the expected results since the compounds are not hypothesized to be subtype-specific like mecamylamine and d-tubocurarine.

Engineering and Physical Sciences
9:00 AM Saturday, April 6, 2002
Battelle Hall 212
Miles K. Free III-Presiding

9:00 WHAT IS REALLY THERE: THE SURFACE COMPOSITION OF METAL OXIDE POWDERS. Amanda L. Sceiford, asceiford@jcu.edu (Michael P. Setter, msetter@jcu.edu) John Carroll University, 20700 North Park Blvd., University Heights OH 44118.
The composition of the surface of particles is essential to the performance of surface reactive catalysts. The purpose of this research is to develop a technique to quantitatively analyze such compositions. The work to date has been in the analyses of metal oxide powders. The technique employed to analyze the surfaces was aqueous stripping. In this technique, layers of the particles are dissolved while the concentration of the stirred solution is monitored over time. Atomic Absorption Spectroscopy, with both flame and graphite furnace, was the method selected to monitor these changing concentrations. The flame atomization method used a microboat to limit the sample size. The elemental analysis of the solution indicates the composition of the layers. The data from this work is then fitted to a model that describes the concentration increase due to the dissolution of powders. In this work, optimum parameters have been obtained for both flame and the graphite furnace by successive improvements. Data fitting the proposed model has been repeated twice. In both of these instances, an unexplained concentration drop occurred approximately fifteen minutes into the dissolution process. Reproducibility has been a problem due to suspended particles being introduced to the instrument with the solution. Altering such parameters, as the acidic concentration of the dissolving solution, the stirring speed, and the dryness of the initial powder has not improved this problem. Future work to improve this situation will use microporous polypropylene membrane filters to remove the "smaller" particles and a sifter to isolate "larger" particles to be dissolved. By preventing particle introduction, the nature of the concentration drop can be investigated. Once explained, the composition of the surface of the particle could be quantified using the proposed model of dissolution.

9:15 INVESTIGATION OF METAL-ORGANIC FRAMEWORKS AS POTENTIAL HETEROGENEOUS CATALYSTS. Ana O. Ramirez, aramirez@muskingum.edu (Paul S. Szalay, pszalay@muskingum.edu) Muskingum College, 163 Stormont St, New Concord OH 43762.
Traditional solid-state syntheses require the use of high temperatures and associated techniques that are very different from those conventionally used in molecular studies. This limitation is largely due to the fact that molecules can generally be manipulated sequentially one step at a time; whereas solids are often assembled in a single step. A high level of synthetic control over the structure and properties of novel extended solid systems has rarely been possible. A new synthetic method involving the precipitation of new materials by mixing solutions of soluble precursor complexes has recently been demonstrated to address this limitation. Aspects of the advantages over the old methods are discussed. Extended systems prepared this way have been found to exhibit desirable properties such as robust framework stability, microporosity, and guest-exchange. The design and preparation of metal-organic frameworks, that are assembled by linking together metal ions with organic molecules is investigated. Our attention is focused on organic ligands with three coordinate donor sites such as hexaazatriphenylene-hexacarboxamide (HAT-$(CONH_2)_6$), and hexaazatriphenylenecarboxilic acid (HAT-$(CO_2H)_6$). These ligands possess desirable structural and electronic features that are well suited to coordinating to transition metals. The metals that we will explore include Ti^{IV} and Zr^{IV}. This is in an attempt to obtain frameworks that have potential to serve as heterogeneous catalysts.

9:30 THE RATIO OF F: Sn AND ITS IMPORTANCE IN THE TRANSPARENT CONDUCTING OXIDE SnO_2: F. Nari N. Talaty,

nari_talaty@hotmail.com Dean M. Giolando, Dept of Chemistry, University of Toledo, Toledo OH 43606-3390.
Tin oxide doped with fluoride is an important and widely studied transparent conducting oxide (TCO) due to its properties and its commercial uses. It has the longest plasma wavelength, best ohmic contact to p-Si, highest thermal stability; it is the hardest and has the lowest cost. Much information is available about the characterization and properties, but the actual stoichiometry of Sn or F present within the crystallites has not been calculated in greater detail. Ratios of F:Sn are based on the relative amounts added to the reactant stream. We employ known standard procedures to determine the actual composition of the thin film. We have studied Tech -15 (Libbey Owens Ford, Pilkington) films having a resistance of about 15 ohms and thickness of SnO_2 layer of 250 nm. Etching of the film was carried out using zinc powder and HCl (3N trace metal grade) and by electrochemical methods using a platinum and a carbon electrode. After successfully etching the surface, by wet chemical and electrochemical methods, analysis for Sn and F were carried out. The tin content was determined using Inductively Coupled Plasma Spectroscopy (ICP), Anodic Stripping Voltammetry and D.C. Polarography. The Fluoride ion concentration was determined using an Orion 9609 F^- Ion Selective Electrode and also via Colorimetry (Alizarin Red). Primary results using ICP yielded a Sn concentration (0.1 to 0.3 ppm) at 186 nm excitation. The fluoride concentration was measured at the ppb levels by using suitable buffers (TISAB II, TISAB II, Glycine:HCl). The measured values are in good agreement with the calculated values. The importance of obtaining the F:Sn ratio is based on the fact that while the carrier concentration increases with the F concentration, it decreases with excess F concentration. Hence, the optimum F concentration still needs to be determined. We can control this parameter (F concentration) during the deposition experiment. Further studies of Tech-8 (650 nm, 8 ohms resistance) and ZnO: F films (1 ohm resistance) are considered.

9:45 PUNCTUATED EQUILIBRIUM AND THE SCREW MACHINE PRODUCTS INDUSTRY. Miles K. Free III, milesfree3@ceoexpress.com 350 Woodland Dr., Medina OH 44256.
A gradualist business model of incremental change has been widely accepted as the predominate model for the screw machine parts manufacturing industry. The "Punctuated Equilibrium Model" first proposed by Steven Jay Gould and Niles Eldridge in 1972 offers an alternative model for viewing this industry plus the challenges and the rate of change it currently faces. Parts per million quality requirements, difficult to achieve using standard statistical methods; industry wide closures of customary suppliers; reverse auction sites and customer retrenchment are examples of the cataclysmic events that are driving the evolution of this industry, indicating the need for a new non gradualist model. Organizational competencies necessary for success in a Punctuated Equilibrium Environment include application of statistics plus data mining techniques to facilitate estimation and costing. Process path documentation and failure mode effects analysis planning to assure raw materials are obtained that are optimized for the application. Error proofing and process improvement techniques to improve process, product, and service quality are also essential to drive organizational performance to 0 PPM levels.

10:00 APPLICATION OF AGILITY PRINCIPLES TO MANUFACTURING INDUSTRIES – THE ASSESSMENT METHODOLOGY, Bahman Ghorashi, b.Ghorashi@csuohio.edu and Nitin Das, Dept of Chemical Engineering, Cleveland State University, Cleveland OH 44115, and Anne M. Ghorashi, AGA Gas Inc: A study was initiated to identify the strategic needs of the adhesive manufacturing sector of the chemical industry in relation to agility principles. An agile company can be defined as an enterprise that is capable of operating profitably in a competitive environment of continually, and unpredictably, changing customer opportunities [1]. In this paper, the authors describe and discuss the methodology that was utilized to assess the agility of three companies that participated in this study. These companies were studied and observations were made with respect to the answers that were provided by these three companies as well as an in-depth analysis of the survey results. In determining the degree of agility of the three selected companies, an assessment questionnaire was prepared. Selected company personnel answered the questionnaire. Separate analyses of the responses were then made for each company. In this paper, we describe the main segments of the questionnaire and the assessment methodology, followed by a discussion of our findings. The analyses of our results revealed that none of the three companies would fully satisfy the different agility criteria that we had outlined. The overall analyses revealed that the three adhesive manufacturing companies seem to, more or less, follow the same trend with respect to their individual operations and showed certain weaknesses in their operations, which we identified.

EDUCATION; SOCIAL & BEHAVIORAL SCIENCES
2:00 PM SATURDAY, APRIL 6, 2002
BATTELLE HALL 212
KENNETH A. LASOTA-PRESIDING

2:00 ANALYSIS OF ACADEMIC COURSES COMMON TO UNDERGRADUATE ENVIRONMENTAL SCIENCE PROGRAMS IN WESTERN PENNSYLVANIA. Kenneth A. LaSota, lasota@robert-morris.edu and Daniel Short, short@robert-morris.edu Robert Morris College, Dept of Natural Sciences, 600 Fifth Ave, Pittsburgh PA 15219-3099.
In developing an undergraduate degree in environmental sciences, Robert Morris College surveyed 45 academic institutions within a 150 mile radius of Pittsburgh, PA and found 27 offered an undergraduate environmental sciences degree. The most common degree names were environmental sciences (13), environmental studies (6) and environmental geosciences (4). Typical host Depts for the programs included environmental studies (8), biology (6) and geosciences (6). Analysis of the academic courses common to the programs centered on whether the curricula required an exposure (here considered at least one course), no exposure (zero courses) or a significant exposure (two or more courses) to seven disciplines. The analysis was limited to courses intended to prepare students for upper level environmental sciences coursework. It was found that 25 programs required a series of courses in physical chemistry. Only 8 programs required a series in organic chemistry, with 13 requiring no organic chemistry courses at all. In physics, 12 programs required a series of courses and 12 required no physics at all. An exposure to calculus was required in 14 programs and 8 required no calculus at all. Statistics was the least required discipline, not required in 18 programs and no program required more than an exposure. Multiple geoscience courses were required in 11 programs and 11 others required no geoscience courses. Finally, a series of biology courses was required by 23 of the programs. The data here may be useful to other institutions developing programs in environmental sciences in western Pennsylvania.

2:15 USE OF PROS/CONS FORMAT HANDOUTS TO INCREASE HOLISTIC THOUGHT PROCESSES AND SCIENTIFIC LITERACY IN NON-MAJORS SCIENCE AND TECHNOLOGY COURSES. Dr. Philip C. Whitford, Pwhitfor@capital.edu Biology Dept, Capital University, 2199 E. Main St., Columbus OH 43209.
Preliminary assessment of student ability to think critically and holistically about broad scale ecological topics and specific news topics in science was attempted on the first day of the Science and Technology Class, a Capital University Core Class for non-majors. A single sheet with three topic areas was presented to the 34 juniors, sophomores and seniors. Working in groups of 3-4, students listed all the PRO and CON comments they could devise per topic. The following two weeks included 10 minutes per class meeting to discuss and list examples of more exhaustive responses to those same topics that illustrated the far-reaching socioeconomic, environmental and political ramifications of even seemingly minor actions, such as construction of a large, multi-million bird, chicken raising facility in a rural environment. Pro/Con responses were evaluated based on number of differing ideas and total words reflected in each pro and con listing. Initial numbers of ideas and words in responses per topic were compared with those of the same student group five weeks later using Pros and Cons written for new topics. For the three topics presented, (mega farming of poultry, nuclear power plant construction/use, GPS and sonar use for commercial fishing) during the first class the average number of ideas and words per "PRO" related by students was 2.36 (range 1-5), 2.09 (range 0-5) and 1.96 (range 1-3), ideas and 11.36, 8.74 and 8.93 words, respectively. The Con's were similar with 2.60 (range 2-5), 2.09 (range 1-3), and 1.96 (range 0-4) ideas reflected in 15.30, 9.83, and 11.3 words per topic. Five weeks later, following discussion and examples, student responses evidenced a mean of 8.25 (range 5-22) ideas and 62.0 words per Pro listed and 9.25 (range 5-26) ideas and 78.0 words per con for the assigned topic. Enthusiastic student response and a significant 4 fold increase in number of ideas and 6 fold increase in words related per group/topic indicate that the experiment was successful at generating an holistic, critical appraisal of current topics once introduced to the idea of thinking beyond the conventional issues.

2:30 A NEW ENGINEERING COURSE CLOSES THE EDUCATION GAP IN APPLYING NATURAL CHANNEL CONCEPTS TO ENGINEERING DESIGN. Kerry L. Hughes, hughes.416@osu.edu Andy D. Ward, ward.2@osu.edu Ann D. Christy, christy.14@osu.edu Dept of Food, Agricultural and Biological Engineering, The Ohio State University, Columbus OH 43210.
The field of natural channel design (considering river geomorphology processes and limiting the use of synthetic construction materials in channel design) is relatively new. The challenge for instructors is to create engineering courses that: provide sufficient basic information to enable students to develop an understanding of the subject; present logical design steps even though the integration of knowledge from different disciplines is not well tested; and provides a vocabulary that enables students to communicate effectively with people of different backgrounds in this field. A new class was offered in the Dept of Food, Agricultural and Biological Engineering at The Ohio State University to determine whether these requirements could be met by: integrating conventional open channel design methods and natural channel concepts; providing knowledge on channel stability requirements and the incorporation of land-use impacts, biological, ecological, and water quality considerations; and providing real world river laboratory experiences, group projects and homework problems. The methodology for assessing the course included the technical quality of the assignments and student evaluations of the course. Students

participating in the class rated (from 1 (low) to 5 (high)) aspects of the course including: participation in team projects (4.4); field labs (4.6); and interaction with the instructor (4.0). Students in the class believed that this course would be relevant to their future studies (4.6) and that they had gained skills from this course (4.4). Another measure of the success of this course was that an actual design was modified based on the recommendations of the students.

2:45 ATTITUDES TOWARD PROSTITUTION. Machelle L. Palmer, mack_4141@hotmail.com (Dr. Andrea Karkowski, akarkows@capital.edu) 2199 E Main St., Capital University, Box 1536, Columbus OH 43209.
This research deals with college students' perceptions and attitudes about prostitution. Most people have a preconceived image of prostitution (Basow, & Campanile, 1990). Clients comprise a larger percentage of the participants in the sex industry; however research has found on the sex workers, rather than their clients or the general public. The purposes of this study were to investigate if there is a difference in the way that college men and women view prostitution and to investigate their views are subject to change based on their being introduce to information. Research indicates that respondents gender influences their attitude about rape and prostitution. In general prostitution is not an understood topic. Prostitutes are often discriminated against due to lack of information. This study hypothesized, based on the information provided, that there would be a significant difference in the responses of males and females and that the participants' responses would significantly change from the first to the second survey. The 26 participants, from freshmen through senior classes at Capital University, were given a packet that contained an initial fourteen-question survey, an attached fact sheet, and a second copy of the same survey with a corresponding number to complete. This survey was created based on an already constructed twelve-question survey by Basow and Campanile. Results were analyzed via single and paired t-test.

3:00 DURATION OF SOCIAL HOUSING AFFECTS BRAIN MONOAMINES AND AGGRESSION IN A RAT MODEL. Jonathan Toot, jtoot@uakron.edu Gail Dunphy and Daniel Ely, University of Akron, Dept of Biology, Akron OH 44325.
The social environment and duration of colony interaction will affect aggression and brain monoamines in the (SHR/y) borderline hypertensive rat model. Noncolony (NC) standard caged rats housed for 10 months, 2 per cage. Long-term (LT) colonies of 10 months and short-term (ST) colonies of 4 months were established. Colony housing conditions consisted of 8 males with 8 females, thereby exposing the males to environmental stresses and allowing a social hierarchy to form. Resident intruder (RI) tests were used to measure resident aggression as the number of attacks on the intruder (AN) and scars given to the intruder (S) in LT and ST colonies. Brain norepinephrine (NE), dopamine (D) and serotonin (5-HT) were measured postmortem by HPLC with electrochemical detection in the medial (AME) and lateral (ABL) amygdala. RI tests showed that the LT had more indices of aggression shown by higher AN and higher S compared to the ST ($p<0.05$). D ABL, 5-HT AME and 5-HT ABL were significantly lower for LT rats compared to ST and NC groups ($p<0.05$). There were no significant differences in monoamines between ST and NC groups. LT showed a linear relationship between the D/NE for the AME and ABL, whereas ST and NC did not. Therefore, a long-term social environment may decrease amygdala serotonin, increase aggression and develop a D/NE relationship between the medial and lateral amygdala.

3:15 CRITICAL SPATIAL FREQUENCIES INVOLVED IN FACE AND FEATURE RECOGNITION. Alicia L. Yonkof, alyonkof@cc.owu.edu Jennifer S. Beighley, jsbeighl@owu.edu David O. Robbins, dorobbin@owu.edu Ohio Wesleyan University, HWCC Box 715, Delaware OH 43015.
Theories of visual encoding have traditionally implemented relatively simple stimuli. One theory suggests that visual encoding is accomplished through channels within neural pathways between the retina and cortex. In humans the sensitivities and spatial frequencies of these channels have been examined using square wave and sinusoidal gratings, producing sensitivity curves. This study examined the degree to which the channels' sensitivity explained the recognition thresholds to complex images (i.e., faces). To illustrate the frequencies critical for facial and feature recognition, thirty-one college-age participants were shown progressively higher frequency digital images of faces that were systematically degraded by Fourier low-pass filters. These spatially filtered images included faces with and without hair, and a prototype with and without altered facial features. The impact of selective adaptation to specific spatial frequencies was measured by presenting vertical or horizontal sinusoidal gratings before and between detection trials. Eliminating hair made the recognition of degraded images significantly more difficult, $F(6,15)=243.21$, $p<0.001$. Facial recognition became increasingly easier after practice, $F(3,9)=10.78$, $p=0.002$, or when higher spatial frequency components were included. Multiple regression analysis showed that at low spatial frequencies eyebrows were more easily recognized on the prototype face than were eyes, mouth, and nose, respectively, $F(5,54)=52.37$, $p<0.001$. On average, spatial frequencies between 8 and 12 cycles per image width were most important for facial recognition. Since these frequencies fall within the range of spatial frequencies generated with gratings, the channels also explain detection of complex images.

3:30 THE ROLE OF NONVERBAL CUES IN THE FORMATION OF ACADEMIC IMPRESSIONS IN A COLLEGE CLASSROOM. Michelle L. Spader, mspader@hotmail.com Holly M. Stubnar, hstubnar@ashland.edu Dept of Psychology, Ashland University, 401 College Ave., Ashland OH 44805.
Nonverbal communication research has demonstrated that nonverbal cues are important in impression formation in a variety of situations that include interviews, interpersonal relationships, and academic settings. This study examined the affect positive or negative nonverbal cues of eye contact, facial expression, posture, clothing, and proximal placement of educational materials would have on the academic impressions formed by 27 professors and 28 undergraduate students. Using a Likert scale, the professors and undergraduate students rated 28 photographs of unfamiliar college students based on their agreement with a statement that conveyed a prediction of academic performance of each photographed student (e.g., "Overall, I believe this student's grade will be superior.") The twenty-seven professors were surveyed months later on their use of subjective evaluation methods (e.g., essay tests, written papers) in their actual classrooms, and how their students are identified per method (e.g., name, code word). A *t*-test indicated both students and professors rated the photographs showing positive nonverbal cues significantly more favorably than the photographs showing negative nonverbal cues ($t=15.73$, $p<.001$). Of the professors surveyed, 100% used subjective evaluation methods, and all were able to identify their students on these evaluations. Nonverbal cues may be important in a college classroom because professors may form favorable or unfavorable academic impressions of their students based on a student's nonverbal cues in class, which may provide an avenue for their grades to be influenced by these impressions if the professors use subjective evaluation methods in which students can be identified.

EARTH AND SPACE SCIENCE I
9:00AM SATURDAY, APRIL 6, 2002
BATTELLE HALL 254
MARK J. CAMP-PRESIDING

9:00 AGES OF GARNET GROWTH IN THE HYDE SCHOOL MARGINAL MYLONITE, ADIRONDACK LOWLANDS, NEW YORK; Nicholas M. Petruzzi, npetruzz@ashland.edu (Michael Hudson, mhudson@ashland.edu) Dept of Chemistry/Geology/Physics, Ashland University, Ashland OH 44805.
The purpose of this study is to thoroughly describe the tectonic fabric of large (1-3 cm dia.), zoned, helicitic, calcium-rich almandine garnets from the Hyde School Marginal Mylonite of the Adirondack Lowlands and to date (U-Pb) monazite inclusions in the cores and rims to verify the hypothesis that there were two episodes of garnet growth, currently based upon textural observations, chemical zoning, and geothermometry. These growth periods have been previously interpreted as occurring during forceful intrusion of the Hyde School composite granitoid (ca. 1170 Ma.) into Lowland marbles which resulted in assimilation and during subsequent Grenvillian syntectonic regional metamorphism (ca. 1150 Ma.). These mylonites consist of garnet-bearing quartzofeldspathic gneisses and garnet-bearing calcsilicate gneisses. Garnet-biotite geothermometry yields core temperatures of 830-860°C, which is considered to be igneous and is consistent with contact metamorphic temperatures elsewhere in the Adirondacks. Rim temperatures of 630-720°C are interpreted as metamorphic overgrowths and are compatible with regional metamorphic conditions determined by others. Initial petrographic observations show extensive evidence of zoning (based upon inclusions), rotation during core growth, and rotation during and after rim growth. Electron microscope work will be used to locate and map replicate monazite inclusions from rim and core regions of the garnets, in four representative samples of both lithologies. Electron microprobe analyses will detail the chemical zoning and provide new data for more extensive geothermometry calculations and the first ever U-Pb dating of monazite inclusions in garnets of the Lowlands. This technique is new, but has been successfully employed by others on garnets from the Black Hills and Montana.

9:15 ALGAL CYSTS OF THE LATE DEVONIAN CLEVELAND SHALE OF OHIO, U.S.A. Wilmer C. Stowe, wilsto@ncweb.com and Shya Chitaley, schitale@cmnh.org The Cleveland Museum of Natural History, 1 Wade Oval Dr, University Circle, Cleveland OH 44106-1767.
Early studies of the Late Devonian Cleveland Shale of Ohio have revealed many arborescent lycopsid axes and cones. Numerous spores and algal cysts have also been found in the macerated shale. The algal cyst Tasmanites are abundant and sometimes are seen as yellow power on the compressed part of the shale. Others belong to the genus Leiosphaeridia. Both genera are indicators of a shallow marine environment as well as presence of oil that is supposed to be around 15% in the shale. These genera differ in their wall structure. A cube of shale matrix from CMNHP-4207 approximately 40 mm on a side was crushed by hammer then subjected to successive treatments with HCl, HF, and Schultz Solution. Wicander_s (1975) water softener liquid technique was used to remove fine clay and organic debris. The residue was dispensed into 9

vials to settle and excessive water removed. More than 75 slides were prepared from the residue using glycerin jelly. Among these algal cysts a number of cysts that are neither Tasmanites nor Leiosphaeridia were observed. They differ in shape being fusiform, spindle-shaped, thin walled, and with a pore at one end. This is the first report of these fusiform cysts from the Late Devonian Cleveland Shale. The average size of the fusiform cysts is (321 mm X 136 mm) while the diameters of the relatively circular Tasmanites and Leiosphaeridia averaged (143 mm) and (260 mm) respectively. These averages are based on a random measurement of thirty different individuals of each form. The fusiform algal cysts comprised 71 of a total 500 algal cysts counted from the 9 microslides examined.

9:30 THE FIRST GEOLOGIC MAPS OF THE SERPENT MOUND DISTURBANCE: DISCOVERY AND REVISION OF AUGUST FOERSTE'S FORGOTTEN MAPS. Gregory A. Schumacher, greg.schumacher@dnr.state.oh.us Ohio Dept of Natural Resources, Division of Geological Survey, 4383 Fountain Square Dr., Columbus OH 43224-1362.

Most authors credit Walter Bucher as the first geologist to map the Serpent Mound disturbance (SMD). Prior to Bucher's mapping of the SMD in 1920, August Foerste, with contributions from Raymond Lamborn, produced the first maps detailing the complex geology of the SMD. In 1918, mapping at the scale of 1:62,500, Foerste produced a manuscript geologic map of the SMD illustrating a central uplifted area of Ordovician- and early Silurian-age rocks surrounded by faulted and folded Silurian- and Devonian-age rocks. Foerste did not show the outer ring of down-dropped Devonian- and Mississippian-age rocks on the 1918 map, but a second manuscript map dated 1919 shows the outer ring and the contacts between the undeformed Ordovician, Silurian, Devonian, and Mississippian rocks arcing around the circular SMD. Foerste's mapping, generalized for presentation at the scale of 1:500,000, was published on the Ohio Geological Survey's 1920 *Geologic map of Ohio*. However, the Ordovician rocks of the central uplift were incorrectly shown as Silurian age. Researching why this error occurred resulted in the discovery of Foerste's original SMD field notes stored at the Smithsonian Institution Archives in Washington, D.C. The notes provided substantial new information detailing the locations of numerous faults, strike-and-dip observations, road cuts, and quarry exposures that were not plotted on his manuscript maps. Revised geologic maps incorporating Foerste's notes compare favorably to the geologic maps produced by later geologists. Clearly, August Foerste was the first to map the complex geology of the Serpent Mound disturbance.

9:45 Break

10:00 PENNSYLVANIAN SANDSTONES OF EASTERN OHIO–THEIR USE AS BUILDING STONES Mark J. Camp, mcamp@geology.utoledo.edu Dept of Earth, Ecological and Environmental Sciences, The University of Toledo, Toledo OH 43606.

Settlement of the Ohio Valley in the 1700s-early 1800s led to the search for local building materials, including sandstone and limestone of the Pennsylvanian strata of the Allegheny Plateau. Due to cyclic deposition of the Late Paleozoic coal basins strata were discontinuous and highly variable in thickness. Most sandstones did not exceed 25 feet in thickness. The Lower Pennsylvanian Massillon Sandstone has the longest history of usage; from the early 1800s to the present. Major quarrying centers included Massillon, Coshocton, Glenmont, Masury, Youngstown, and Zanesville. Middle Pennsylvanian Lower Freeport Sandstone came from the hills around Lisbon, East Liverpool, and Uhrichsville; Lower Mahoning and Buffalo sandstones were extensively quarried at Corning, Steubenville, and Tippecanoe. The Upper Pennsylvanian Pomeroy Sandstone served the Pomeroy-Middleport area. The sandstones served as foundation stone for many local houses and barns, locks along the Sandy & Beaver Canal, the B&O viaduct at Bellaire, and the suspension bridge at Wheeling, WV; better grades found use in the walls of courthouses in Cambridge, Lisbon, and Millersburg; Broad Street Presbyterian Church and the Southern Hotel in Columbus; St. Marys Catholic Church in Massillon; Gallipolis State Institute; brownstone residences in New Philadelphia; and many other prominent churches, mansions, and government buildings throughout the region. The brown phase of Massillon stone was shipped as far as California and Massachusetts for use in brownstone buildings. The old gymnasium at Yale University in New Haven, CT was constructed of Massillon stone from the Briar Hill Stone Co. By 1900 most of the quarries were idle. The capricious nature of the stone, its tendency to discolor with age, and increased competition from more widely marketed stones led to its demise. The Briar Hill Stone Co. of Coshocton is the lone present producer; 24,094 tons were quarried in 2000.

10:15 THE MAKING OF THE 3-D SURFICIAL-GEOLOGY MAP OF THE MAD RIVER AND LITTLE DARBY CREEK WATERSHEDS. Douglas L. Shrake, doug.shrake@dnr.state.oh.us C. Scott Brockman, Kim E. Vorbau, and Richard Wynkoop, Ohio Dept of Natural Resources, Division of Geological Survey, 4383 Fountain Square Dr., Columbus OH 43224-1362.

The 1:100,000-scale 3-D surficial-geology map of the Mad River and Little Darby watersheds depicts multiple map-unit areas that show the thickness and stratigraphic sequence of unconsolidated materials from the surface down to and including the uppermost bedrock unit. Mapping was partially funded by an Ohio EPA 319 grant. The map area for the Mad River and Little Darby watersheds covers 26 7.5-minute quadrangles and encompasses portions of 10 counties in west-central Ohio: Champaign, Clark, Delaware, Franklin, Greene, Logan, Madison, Miami, Montgomery, and Union. Production of the map occurred in phases. The initial phase had several steps: 1) obtaining and inventorying existing geologic data and maps for the map-area on file at the ODNR, Division of Geological Survey, 2) obtaining geotechnical data from the ODOT, Office of Materials Management, Soils and Foundations Section, the Southwest and Central Ohio EPA District offices, the ODNR, Division of Water, the ODNR, Division of Soil and Water Conservation, and the USGS Water Resources Division, and 3) transcribing these data onto 7.5-minute topographic maps. The second phase had two steps: 1) revision of existing bedrock-topography and bedrock-geology maps where new data indicated a need for re-interpretation and 2) the creation of the 3-D map-unit areas based on the transcribed data maps, bedrock-geology maps, and bedrock-topography maps for each quadrangle. The third phase involved digitization of the 1:24,000-scale 3-D map-units and their compilation at the scale of 1:100,000. The final phase had: 1) an editorial step, for verification of the 3-D map-area labels and contacts, and 2) a cartographic step, for the colorization and labeling of the map using ArcView®. The print-on-demand map will be available from the Ohio Division of Geological Survey.

10:30 GEOCHEMISTRY OF THE MUNICIPAL WATER AND OF THE SANDUSKY RIVER AT BUCYRUS, OHIO. Everett H. Fortner III, fortner.21@osu.edu and Gunter Faure, faure.1@osu.edu The Ohio State University, 275 Mendenhall Laboratory, 125 S Oval Mall, Columbus OH 43210.

Streams provide cities and towns with water and a means of discharging wastewater. The discharge of this effluent may significantly alter the chemical composition of a stream. Further downstream, other cities and towns use the same water, which could pose possible health risks. To study this problem, the municipal water system and the Sandusky River at Bucyrus, Ohio were sampled on December 15, 1999 to determine the effect of the municipal use on the chemical composition of the river. Bucyrus has a population of 16,000 and is located in Crawford County, north-central Ohio. The Sandusky River flows through the city and continues north discharging into Lake Erie. Eight water samples from the Sandusky River and five water samples from the Bucyrus municipal water system were collected. All of the samples were filtered and acidified prior to analysis by XRAL Laboratory in Toronto, Ontario, using ICP-OES. The results show increased concentrations of Mg, Ca, K, Na, and Sr in the effluent compared to the purified tap water. The discharge of the effluent also increases the concentrations of trace elements Co, Cu, and Zn by 50 µg/L. Overall, the Sandusky River is not significantly altered by the city of Bucyrus and therefore does not pose a health risk to near-by towns and animals.

EARTH AND SPACE SCIENCE II
2:00PM SATURDAY, APRIL 6, 2002
BATTELLE HALL 254
JEFFREY J. GORDON-PRESIDING

2:00 A HIGH RESOLUTION GIS FOR ENVIRONMENTAL MODELING, NORTH APPALACHIAN EXPERIMENTAL WATERSHED, COSHOCTON, OHIO. Erik R. Venteris, venteris.1@osu.edu and Brian K. Slater, slater.39@osu.edu The Ohio State University, School of Natural Resources, 2021 Coffey Rd, Columbus OH 43210.

A high resolution (1:2400 scale) GIS was created for the North Appalachian Experimental Watershed (NAEW) for use in environmental modeling. The intended application for the data set was regression-based spatial modeling of soil properties such as percent organic carbon. It was hypothesized that a 2 m resolution DEM created with this GIS would predict soil properties better than DEMs created from USGS 1:24,000 contour maps. The central task in creating the GIS was to digitally capture existing contour maps and convert them into a 2 m digital elevation model (DEM). Elevations, streamlines, and watershed boundaries were digitized from legacy 1:2,400 topographic maps derived from aerial photogrammetry in 1960. Contours and streamlines were captured through a process of hand tracing, scanning and finally raster to vector conversion. Elevation contours and streamlines were used as inputs to ANUDEM software to calculate a DEM with realistic surface drainage properties. Additional products such as slope, profile curvature and the compound topographic index (CTI) were calculated using GRASS 5.0 software. Final vector products of the GIS include elevation contours, legacy soil data, zero-order watersheds with management records from 1939 to the present, land cover derived from digital orthophotography, and streamlines. Final raster components include the DEM and many derived topographic parameters, most of significance to modeling surface hydrology. The predictive ability of the 2 m DEM and a 10 m DEM calculated with ANUDEM from 1:24,000 USGS contour maps was compared. A multiple least squares regression was conducted on 185 soil samples to predict % carbon from topographic parameters derived from the DEMs. Two topographic parameters were

predictive (F score > 1, Probability e•F less than 0.01 in effect tests) from the 2 meter DEM, none from the 10 m DEM. The 10 m DEM is insufficient for modeling soil properties for zero-order (5,000 m^2) watersheds.

2:15 THE LOCATION OF BACTERIAL AND FUNGAL CELL WALL PRODUCTS IN SOIL AGGREGATES FROM NO-TILLAGE AND CONVENTIONAL TILLAGE AGROECOSYSTEMS. Rod T. Simpson[1], simpson.231@osu.edu Serita Frey[1], frey.77@osu.edu Johan Six[2], johan@nrel.colostate.edu [1]The Ohio State University, School of Natural Resources, 2021 Coffey Rd, 210 Kottman Hall, Columbus OH 43210 and [2]Colorado State University, Natural Resource Ecology Laboratory, Fort Collins CO 80523.
Microbial-derived organic matter is deposited on and distributed throughout soil aggregates. This material can originate either from bacteria or fungi, but is not distributed evenly throughout the aggregate. This study determined where bacterial and fungal-derived organic matter is located within the aggregate structure of soil collected from no-tillage (NT) and conventional tillage (CT) agroecosystems. Soil samples (112) from a long-term tillage comparison experiment in Horseshoe Bend, GA were sepllllllal networks, are important for aggregate formation. This research demonstrates that bacterial versus fungal-derived organic matter is found in different locations within the soil aggregate structure and may be differentially protected from decomposition.

2:30 THE EFFECT OF CLAY CONTENT ON THE DEGRADATION OF MICROBIAL CELL WALL PRODUCTS IN NO TILLAGE AND CONVENTIONAL TILLAGE AGRO-ECOSYSTEMS. Tonia White-Burford[1], white.820@osu.edu Serita Frey[1], frey.77@osu.edu Johan Six[2], Johan@nrel.colostate.edu [1]The Ohio State University, School of Natural Resources, 2021 Coffey Rd, 210 Kottman Hall, Columbus OH 43210 and [2]Colorado State University, Natural Resources Ecology Lab.
Glucosamine and muramic acid concentrations can be used to establish cumulative fungal and bacterial (respectively) cell wall product concentrations in soil. This is of interest because microbial-derived organic matter may contribute to the sequestration of carbon in agricultural soils. The purpose of this study was to determine the effect of clay content on the degradation of microbial cell wall products within two tillage treatments (no-tillage and conventional tillage) at three long-term tillage comparison sites in Ohio, using laboratory incubation. The sites were Hoytville (50% clay), South Charleston (32% clay), and Wooster (25% clay). Eighteen samples (9 of each treatment) were collected in May and June 2001 at each field site to a depth of 0-20 cm, sieved (2mm) and analyzed for soil moisture, texture, bulk density, and total organic carbon and nitrogen. Subsamples (108 of 50 g each) were incubated at 25°C for 270 days. At days 15, 30, 60, 90, 180, and 270 samples were analyzed for glucosamine and muramic acid concentrations, total C and N, and particulate organic matter C and N. The data were analyzed by analysis of variance. As hypothesized, clay content had a positive effect on the retention of amino sugars. As clay content increased, the degradation rate decreased. Tillage regime, particularly CT had an increased effect on glucosamine degradation, while there was no effect of conventional tillage on the degradation of muramic acid. Tillage regime did not outweigh the effect of texture; with the high clay plots showing a decrease in the rate of microbial derived amino sugar decay over the incubation.

2:45 CLIMATIC AND GEOLOGIC FACTORS CONTRIBUTE TO SINKING HOUSES ON THE OHIO TILL PLAIN. C. Scott Brockman, scott.brockman@dnr.state.oh.us Thomas M. Berg, Thomas.Berg@dnr.state.oh.us Ohio Dept of Natural Resources, Division of Geological Survey, 4383 Fountain Square Dr., Columbus OH 43224-1362.
Surficial organic deposits are not common on the Ohio till plain; however, three houses in the north Columbus neighborhood of Sharon Woods had to be leveled owing to structural damage from sinking into peat and gyttja. We investigated the factors that contributed to the damage, which developed after nearly 15 to 30 years of stability. Coring, laboratory testing, and topographic interpretation indicate that foundations rested on 7 to 15 feet of organic-rich peat, gyttja, silt, and clay that filled a late-glacial, closed, linear depression. In a battery of tests on 11 samples, deposits consolidated a relatively large amount with pressure, shrank 20% when dried, and swelled upon wetting to levels termed critical to very critical. Structural damage, however, was related primarily to shrinkage and not to swelling of the sediments; for example, support posts separated from beams, and a 6- to 8-inch void underlaid most of the basement slab of one house. The Palmer Hydrological Drought Index correlates fairly well with the 15- to 30-year delay of the onset of damage. Fifteen years of average to wet climate followed house construction, and damage was reported only during droughts. Roofs, drives, roads, and lawns cover much of the neighborhood and deliver potential ground water to storm sewers. Diminished local ground-water recharge dries the soil and in turn increases the load on underlying sediments by reducing the buoyant pressure. Desiccation shrinkage of surficial sediments and pressure consolidation of deeper organic sediments combined to cause irreparable damage to the houses. A solution to this type of foundation failure may be to establish a water drip system under and around houses in highly organic soils.

3:00 RECENT ACTIVITIES AROUND, OVER AND IN AN ABANDONED, UNDERGROUND COAL MINE, STARK COUNTY, OHIO. James R. Bauder BAUDER CERTIFIED EARTH SCIENCES Inc., 6106 Armistice Avenue NW, Canton OH 44718.
Two adjacent underground coal mines working the same Brookville (No.4) coal seam were abandoned in 1929 and 1930. These combined mine workings underlie an area of more than 70 acres. These mine workings were/are labeled on public maps, known to most governmental units, and realtors in the area. Maps of the mine workings are available. This area remained as open space because of the known mines as urban development was discouraged. Stark County adopted regulations to deny and prevent development over recorded underground coal mines. During the 1970's subsidence involving a few houses over the outer limits of this mine were corrected by grouting. Other areas show cave-in depressions up to eight (8) feet deep. Rarely are buildings approved over underground mines. Only after the owner/occupant agrees in writing that they will hold the County and its employees harmless, and will accept all responsibility for any events growing out of the requested approval will they be granted application. In the early 1980's, a housing development was built over a portion of this mine, with full knowledge and approval of local governmental bodies. Subsidence began in the late 1990's, and was corrected by grouting. Total excavation of mine workings and controlled backfilling of a site was carried out after the turn of the century.

3:15 Break

3:30 THE RATIONAL COMPREHENSIVE MODEL AND ENVIRONMENTAL DECISION-MAKING WITHIN THE CITIES OF HUDSON AND STREETSBORO, OHIO. Emmanuel K. Mbobi, embobi@stark.kent.edu Kent State University, Stark, Dept of Geography, 6000 Frank Avenue, NW, Canton OH 44720.
The decision-making process shapes policy formulation. It is the core process of managerial functions acting as a binding element that holds together planning, organization, direction, and control. Most cities and municipalities make decisions by using some existing decision-making model or parts of some existing model. This research documents the processes and model used by Hudson and Streetsboro, Ohio, in making critical environmental decisions between 1975 and 1995. Both cities have some spatial relationships and similarities. Juxtaposed to each other, both measure 25 square miles each. They lie at the intersection of major transportation hubs such as Interstate 77, 480, 80, 76, and state route 14, 43, 303, and 90. Data sources included newspaper articles reflecting environmental issues such as water and air pollution, and wetlands destruction; zoning meeting minutes, and town hall council meeting minutes that discussed environmental issues. In addition, six decision-making models were examined – the Incremental Model, the Creative Model, the Garbage Can Model, the Mintzberg Model, the Mixed Scanning Model, and the Rational Comprehensive Model to see if any of these models were used in the decision-making process for both cities. The Rational Comprehensive Model is a five-stage process – 1. *Recognizing the problem; 2. Agreeing on the facts and overall objectives; 3. Identifying alternative solutions; 4. Making choices; and 5. Implementation.* The Rational Comprehensive Model was the only decision-making model that represented the decision-making process used by both cities, even though the City of Streetsboro lacked the fifth stage of the model. The study indicates that many cities write ordinances using different models that guide them through the process.

3:45 ROADSIDE MEMORIALS: A MODERN GEOGRAPHICAL CONTROVERSY. Jeffrey J. Gordon, jeffgor@bgnet.bgsu.edu Dept of Geography, Bowling Green State University, Bowling Green OH 43403.
Victims of highway fatalities are sometimes remembered with the impromptu construction of roadside memorials by their relatives and friends. Commemorating the premature loss of life of loved ones, these simple monuments, often crosses engraved with the name of the deceased and adorned with flowers, mark the site of the tragedy in the right of way. The purpose of this study was to research the legal status of these controversial, often unauthorized, markers. Along with photographs taken of this popular culture landscape feature, computer searches for literature on these roadside memorials throughout the United States, as well as interviews with Ohio and Michigan state officials, were conducted. It was found that the treatment of this highly sensitive and emotional activity by authorities varies widely from state to state and that official policies in many areas are just recently being created or reviewed. Depending on the region, transportation officials can have the memorials removed, allow them to remain for a designated period of time, or replace them with state-issued roadside markers to be taken down eventually and a fee charged to the victims' families. More specifically, for example, some districts allowing roadside memorials have instituted height, width, and construction material requirements. Some districts limit memorials to only those fatalities resulting from drunk driving accidents.

4:00 RELOCATING ELDERLY SERVICES WITH GIS: A CASE STUDY OF LUCAS COUNTY, OHIO. Yu Zhou yzhou@bgnet.bgsu.edu Bruce Smith, Dept of Geography, Bowling Green State University, Bowling Green OH 43403.
During the past six decades, the spatial distribution of the elderly in most US cities has experienced a significant change. In city of Toledo, Ohio, for example, the census tracts with higher percentages of the elderly were concentrated in the downtown area in 1950 and 1960. This pattern of inner city concentration, however, started to change

in 1970. By 2000, the census tracts with the highest percentages of elderly population were mostly distributed in suburban areas. Even though the spatial distribution of older Americans has changed, the location pattern of services has not shifted substantially. In Lucas County, the senior service centers are mostly located in the same places as 30 years ago. In this presentation, the strategies of relocating such services with the use of GIS (Geographic Information Systems) are demonstrated.

ENVIRONMENTAL SCIENCE
9:00 AM SATURDAY, APRIL 6, 2002
BATTELLE HALL 289
CAROLYN J. MCQUATTIE-PRESIDING

9:00 EFFECT OF RIPARIAN HABITATS ON BIODIVERSITY IN SMALL AGRICULTURAL DITCHES. Gregg T. Sablak, sablak.2@osu.edu Virginie Bouchard, bouchard.8@osu.edu Environmental Science Graduate Program and School of Natural Resources, 2021 Coffey Rd, Columbus OH 43210.

Our research determined the effect of riparian habitats on the aquatic biodiversity of agricultural ditch ecosystems. Channel modification is common in agricultural landscapes and in-stream habitats are altered and streams are disconnected from their floodplains. Little research has been conducted in agricultural ditch ecosystems despite their large numbers, particularly in the Midwest. Our central hypothesis was that reestablishment of a floodplain connection and riparian habitats will increase biodiversity in agricultural ditches. Fifteen reaches were selected along ditches in Northwest Ohio according to three conditions: five were surrounded by a riparian system (i.e., presence of trees), five were connected to a small floodplain, and the last five had no riparian and no floodplain connection. To measure biodiversity, benthic invertebrates, amphibians and plants were sampled at 4 to 8 locations in each reach during the summer and fall 2001. Our data suggest that benthic substrate is the limiting factor controlling biodiversity in such a stressed landscape. Up to 25 species of macroinvertebrate were found in some reaches, but our preliminary results indicate no significant differences between the three treatments. Our data however suggests that benthic community structure (e.g., feeding groups) respond to increased food resource (e.g., detritus) inputs from riparian zones with tree cover.

9:15 VEGETATION SURVEYS FOR CONSTRUCTED WETLANDS OF THE WETLAND RESERVOIR SUBIRRIGATION SYSTEMS (1998-2001). Lee M. Luckeydoo, Luckeydoo.1@osu.edu Ohio State University 590 Woody Hayes Dr., Columbus, Ohio 43210.

The Wetland Reservoir Subirrigation System (WRSIS) project links agricultural fields, wetland, and a storage reservoir to help minimize agrochemical runoff and sediment delivery to streams. Three demonstration sites are located in Defiance, Fulton, and Van Wert counties in northwest Ohio, were constructed approximately six years ago. Case studies of terrestrial and aquatic vegetation development and structure on the three sites were conducted. Surveys were completed on all sites using annually permanent quadrats, and observations were made using Braun-Blanquet scales. Survey information indicates that species richness declined during the study period at all three locations. Species richness at the Defiance location declined from 51 species in 1998 to 30 in 2001. Fulton's species richness declined from 32 in 1998 to 22 in 2001. The species richness at the Van Wert location declined from 45 in 1998 to 21 in 2001. Over the period of this study, year three through year six post-construction, overall diversity has decreased, but there has been a general increase in percent wetland indicator species. Wetland indicator species were most abundant in Defiance (43%) and Fulton (46%) in 1999, and in 2000 for Van Wert (56%). Perennials account on average for 71.4% at Defiance, 52.4% at Fulton, and 57.3% at Van Wert of the wetland indicators species. Using life history information on species presently on site and species available in the seed bank, a management plan using water level manipulation to encourage growth of wetland and terrestrial species that have promising water quality improvement capabilities has been developed.

9:30 DOES A CORRELATION BETWEEN THE FLORISTIC QUALITY INDEX AND COEFFICIENTS OF WETNESS EXIST. Tracy L. Engle[1], tracy_engle@urscorp.com and Jeffery R. Johansen[2], johansen@jcu.edu [1]URS Corporation, 800 W. St. Clair Ave., Cleveland, OH 44113 and [2]John Carroll University.

Methods of establishing indices to measure the floristic quality of habitats in northern Ohio have been established. Others have suggested assigning coefficients of wetness to species based on the wetland indicator status as assigned for Ohio. In order to determine if woodlots that receive high floristic quality index scores are associated with wetlands, we established transects to sample six different woodlots in Geauga County, Ohio. This study evaluated the floristic quality of forestland and whether a relationship between the floristic quality index and the coefficient of wetness exists. Six woodlots within the watershed of the East Branch Cuyahoga River in Geauga County were selected from the USGS topographic map. Within each woodlot we established a 1 kilometer transect with 30-meter radius plots located every 100 meters. Woody species including trees, saplings and shrubs were identified and quantified within each plot. For data analysis, a value of floristic quality and coefficients of wetness were assigned to each species encountered and the floristic quality assessment index, as well as the wetness index, was calculated for each plot. The results of this study determined that a strong correlation between the floristic quality index and coefficients of wetness could not be made during this study of forest land in the upper Cuyahoga River watershed. However, modifications to the methods proposed by Andreas and Lichvar for calculating the floristic quality index which include a weighted calculations as well as inclusion of non-native taxa was found to more strongly correlate with the coefficients of wetness.

9:45 EXAMINATION OF THE RELATION OF NITRATE LOADS AND LAND USE IN THE BIG DARBY CREEK AND ALUM CREEK WATERSHEDS IN CENTRAL OHIO. Nathan B. Carse, ncarse51@hotmail.com (Terry Lahm, tlahm@capital.edu) Capital University, Environmental Science Program, 2199 E. Main St., Columbus OH 43209.

From July 9 through August 1, 2001, water samples were taken from Big Darby Creek and Alum Creek watersheds in order to characterize nitrate (NO_3^-) concentrations. At the same time, stream discharge was measured in order to determine nitrate load at each of the sampling locations. Alum Creek is part of the Scioto drainage basin with an approximate area of 520 km^2 and is dominated mainly by urban uses in its southern extent, with minor agricultural areas in the north. The flow for this stream is hydrologically controlled at Alum Creek Reservoir. The Big Darby Creek is located on the west side of the Scioto drainage basin, draining approximately 1,450 km^2, dominated by agricultural land use, with minor urban areas. The hypothesis for this study is that higher nitrate loads will be found in the Big Darby Creek, than in Alum Creek, due to the extensive use of nitrogen-based fertilizers in the Big Darby watershed. A USGS pygmy flow meter was used in determining the discharges. Discharge ranged from 0.015 to 0.72 m^3/sec for Alum Creek, and from 0.47 to 2.2 m^3/sec for the Big Darby. The nitrate concentrations were determined using Standard Methods 4500-NO_3^- and resulted in nitrate loads ranging from 70 to 150 kg/day for Alum Creek and 80 to 410 kg/day for Big Darby Creek. The land use data were derived from 1994 and 1998 Landsat Thematic Data processed in Arcview GIS, to determine land use characteristics and drainage areas in both watersheds.

10:00 COMPARISONS OF LIVER SOMATIC INDEX IN BROWN BULLHEAD FROM BLACK RIVER, BUCKEYE LAKE AND OLD WOMAN CREEK. Xuan Yang[1], yang.318@osu.edu Mark E. Ashbaugh[2], mark_ashbaugh@yahoo.com Paul C. Baumann[1,3], baumann.1@osu.edu [1]Ohio State University, Environmental Science Graduate Program, 2021 Coffey Rd, Columbus OH 43210, [2]VA Medical Center, 3350 La Jolla Village Dr., Rm. 6045, San Diego CA 92161 and [3]National Biological Service, 2021 Coffey Rd, Columbus OH 43210.

The liver-somatic index (LSI) in fish is a relatively rapid response indicator of changes in conditions of fish and the aquatic environment. A total of 563 Brown bullhead (*Ameiurus nebulosus*) collected from Black River in 1981, 1982, 1992, 1993, 1994, 1995 and 1996, from Buckeye Lake in 1981 and 1982, and from Old Woman Creek in 1992, 1993, 1994, 1995 and 1996 were examined for the LSI. The sediments in Black River were highly contaminated with PAHs in the early 1980s, but the level of contamination declined after the closing of an upstream coking facility in 1983, and most of the contaminated sediments were dredged in 1990. No industrial sources were found in Buckeye Lake and Old Woman Creek and therefore they were selected as reference sites. The results showed that the mean LSI of female fish tended to be higher than that of male fish. Multiple directional t-tests with a Bonferroni adjusted $\pm$ value indicated that the males from Black River had statistically higher LSI than those from the reference sites in every collection year. The females had the same trend for all the years except 1994. The mean LSI in the early 1980s was significantly higher than that in the 1990s for both males and females from Black River using Fisher's least significant difference test. The increases observed in the mean LSI of brown bullhead were associated with the levels of contamination. This study provides evidence that exposure to contamination can result in increased relative liver weights in brown bullhead.

10:15 LINKAGES BETWEEN MACROPHYTE DIVERSITY, MICROBIAL DIVERSITY AND TRACE GAS FLUXES Janice M. Gilbert, gilbert.153@osu.edu Serita Frey, frey.77@osu.edu Virginie Bouchard, bouchard.7@osu.edu Environmental Science Graduate Program, Rm 210 Kottman Hall, 2021 Coffey Rd, Ohio State University, Columbus, OH 43210.

Our study examined the relationships among aquatic plant (macrophytes) diversity, microbial diversity, and the biochemical reduction of nitrate (denitrification) in a mesocosm experiment. Although previous studies have identified physical and chemical factors regulating the production of denitrification gases, the role that macrophyte diversity plays in this process is still not known. Our central hypothesis was that declines in macrophyte diversity would cause decreases in microbial diversity and significantly increase the flux of nitrous oxide relative to that of dinitrogen gas. Sixty mesocosms (417 liter tubs) with combinations of either 0, 2, 4, 6, 8, or 10 macrophyte species were tested for *in situ* gas fluxes of N_2O:N_2, denitrifying enzyme activity (DEA), bacterial biomass, and microbial community diversity. *In situ* denitrification gas samples were obtained using the acetylene block method; the

DEA method determines the potential denitrifying capacity of samples under non-limiting conditions for denitrifying bacterial metabolism; bacterial biomass was determined using epifluorescence microscopy coupled with computer assisted image analysis; and microbial community diversity was analyzed using the terminal restriction length polymorphism (T-RFLP) analysis. Denitrification activity increased with increasing plant diversity. Mesocosms with the highest plant diversity exhibited fluxes of denitrification gases between 6-9 ppm over a 24hr period while mesocosms with the lowest plant diversity had fluxes between 1-3.5 ppm. Our data also suggest that the type of plant present influences denitrification and the nitrous oxide: dinitrogen ratio. Our study indicates that altering biological diversity affects ecosystem function (i.e. denitrification) and therefore has potentially important implications for global climate change.

10:30 YELLOW-POPLAR FOLIAR ANATOMY FOLLOWING FOUR YEARS EXPOSURE TO ELEVATED OZONE AND/OR CARBON DIOXIDE. Carolyn J. McQuattie, cmcquattie@fs.fed.us Joanne Rebbeck, jrebbeck@fs.fed.us USDA Forest Service, 359 Main Rd., Delaware OH 43015.
Ozone-induced injury to leaf cells may be ameliorated by concomitant exposure to elevated carbon dioxide (CO_2) that increases photosynthetic and repair capabilities in leaves. To evaluate foliar effects of ozone in the presence or absence of elevated CO_2, yellow-poplar (*Liriodendron tulipifera*) seedlings, planted in open-top chambers, were exposed for four seasons to either carbon-filtered air (CF), twice ambient ozone ($2xO_3$), or $2xO_3$ plus elevated (700 ppm) CO_2 ($2xO_3$+CO_2). In August, segments of mature leaf blades from each treatment were chemically fixed and embedded in epoxy resin for examination by transmission electron microscopy. In mesophyll cells of CF-treated leaves, ovoid chloroplasts were tightly appressed to cells walls and had thylakoid membranes with parallel alignment. In mesophyll cells from $2xO_3$-treated leaves, rounded chloroplasts generally were not appressed to cell walls and had separated or indistinct thylakoid membranes. In $2xO_3$+CO_2-treated leaves, rounded chloroplasts were filled with numerous starch grains, and although fewer thylakoid membranes were visible, their structure was similar to those from CF-treated leaves. Mesophyll cells from both $2xO_3$- and $2xO_3$+CO_2-treated leaves had disrupted tonoplasts and deteriorated cytoplasm compared with the CF treatment. Cuticular membranes of leaves grown in $2xO_3$-air were 35% thinner than those of CF-air leaves (N=15/treatment; p=0.002; ANOVA), and, though not statistically different, cuticular membranes from $2xO_3$+CO_2-treated leaves were 8.6% thicker than those from the $2xO_3$ treatment. Although the addition of elevated CO_2 did not ameliorate all O_3-induced injury, the presence of abundant starch and a more typical thylakoid structure in chloroplasts along with slightly increased cuticle thickness suggests some CO_2-induced compensation for O_3 injury.

10:45 PHOSPHOROUS SOIL LEVELS ON AMISH FARMS IN NORTH CENTRAL OHIO. James J. Hoorman, jhoorman@postoffice.ag.ohio-state.edu Ohio State University Extension, One Courthouse Square, Ste 40, Kenton OH 43326-2399. With a United States Department of Agriculture water quality grant, three Amish communities participated in a soil-testing program to improve phosphorous management. In a three-year period (1998-2000), 871 soil samples were analyzed from 89 Amish farms representing over 6600 acres. The soils were tested for available phosphorous using the Bray P1 extraction method. Three hundred thirty-six (38.6%) samples tested below 15 Parts Per Million (PPM) P, considered low for optimal crop yields. Three hundred sixty-four (41.8%) samples tested between 15 and 50 PPM P (medium to medium-high) and one hundred seventy-one (19.6%) samples tested greater than 50 PPM P (high). The average P values were: 49.3 PPM for the Belle Center community, 41.0 PPM for the Kenton community, and 21.6 for the DeGraff community. Sample sizes were Belle Center-139, Kenton-587, and DeGraff-145. Using a standard t-test for mean comparison, the Belle Center and Kenton communities averages were significantly different from the DeGraff community's but not from each other at the 1% level of significance. Factors associated with high P soil test included farms with a high ratio of livestock per acre (>1 animal unit/acre), fields located close to the barn for manure disposal, fields planted to vegetable crops and permanent pastures, and barn feedlots. Factors associated with low phosphorous were farms with a lower livestock density (<1 animal unit/acre), fields with long hauling distances from the barn for manure applications, fields rotated to row and small grain crops, and little or no commercial fertilizer usage.

WATER QUALITY
2:00 PM SATURDAY, APRIL 6, 2002
BATTELLE HALL 289
YUNG-TSE HUNG-PRESIDING

2:00 THE IMPACT OF URBANIZATION ON GROUNDWATER DISCHARGE TO THE HELLBRANCH RUN TRIBUTARY OF THE BIG DARBY WATERSHED. Andrew P Hudgins, ahudgins@capital.edu (Terry Lahm, tlahm@capital.edu), Capital University, Environmental Science Program, 2199 East Main St., Columbus OH 43209.
The Hellbranch Run is a small stream located in Franklin County, Ohio that drains 56.9 km^2 from the western edge of the city of Hilliard to the village of Darbydale in the south. The upper part of the stream is composed of two main tributaries known as the Hamilton Ditch and the Clover Groff Ditch both draining the Darby Till Plain. This study examines the impact of urban development and the implementation of impervious surfaces on the groundwater discharge to the Hellbranch Run. The hypothesis is that the groundwater discharge to the stream will decrease as a result of increased areas of impervious surfaces and storm sewers that discharge water directly into the creek. The urbanization process can short circuit the hydrologic cycle limiting the amount of groundwater recharge. Stream flow measurements using the velocity-area method were gathered at five locations throughout the Hellbranch watershed over five sampling times throughout the summer and fall of 2001. The discharge measurements indicated a net groundwater influx of 2240 m^3/d over the Clover Groff Ditch and 740 m^3/d over the Hamilton Ditch. The land use in the Hamilton Ditch drainage is predominately agricultural compared with the Clover Groff Ditch drainage that is dominated by suburban development. The lower part of the Hellbranch had a groundwater discharge of 12,920 m^3/d. Currently, a second methodology is being employed to examine the base flow recessions for any temporal changes in groundwater discharge over the entire watershed for a nine-year period of record.

2:15 EFFECT OF PHENOL ON TREATMENT OF FOOD WASTEWATERS BY AEROBIC BATCH REACTOR. Yung-Tse Hung and Elizabeth Atu, Civil Engineering Dept, Howard H. Lo, Dept of Biological, Geological, and Environmental Sciences, Cleveland State University, Cleveland OH 44115.
The objective of the study is to determine the effect of phenol on the treatment performance of batch activated sludge reactors in treating food wastewater. The types of food wastewater investigated include potato wastewater, sugar wastewater and combined potato and sugar wastewater. The experimental parameters investigated in this study consist of 3 types of food waste strength, 3 levels of aeration tank biomass concentration, 3 levels of phenol concentration, and 4 aeration periods. Effect of yeast addition on the reactor treatment performance was compared to the LLMO (live liquid microorganisms) addition. The batch reactor run was conducted for 24 hours period. Two sets of experiments were conducted. Set 1 consisting of runs 1, 2 and 3 were without bioaugmentation with LLMO, while set 2 consisting of runs 4, 5, and 6 were with bioaugmentation of LLMO. TOC (total organic carbon) was determined for the reactor content at 0, 3, 6, 12, and 24 hours period. Three levels of phenol consisted of 55, 150, and 245 mg/L. The phenol level was low (55 mg/L), for runs 1 and 4, was medium (150 mg/L), for runs 2 and 5, and was high (245 mg/L) for runs 3 and 6. The percentage TOC removal at 12-hour aeration period ranged from 17.7 to 44.97% for set 1 without LLMO bioaugmentation and ranged from 8 to 73.9% for set 2 with LLMO bioaugmentation. The general trend indicated that TOC removal efficiencies decreased as phenol concentration increased. Food wastewater strength was found to have an important effect on the reactor performance. When aeration period was increased to 24 hours, the toxic effect of phenol was decreased. Bioaugmentation with LLMO improved batch activated sludge reactor performance. A 24 hours aeration period is necessary to overcome the toxic effect of phenols.

2:30 FOOD WASTEWATER TREATMENT WITH ADSORPTION AND BIOAUGMENTATION. Yung-Tse Hung, and Indira Yaddanapudi, Civil Engineering Dept, Howard H. Lo, Dept of Biological, Geological, and Environmental Sciences, Cleveland State University, Cleveland OH 44115, Ruth Yu-Li Yeh, Chemical Engineering Dept, Ming-Hsin Institute of Technology, Hsinchu, Taiwan.
The purpose of the study is to determine the effectiveness of clay adsorption and bioaugmentation on the removal of organic pollutants from food wastewater. Shaking runs were conducted for the batch reactor for a period of 48 hours. There types of food wastewater investigated included potato wastewater, sugar wastewater and combined potato and sugar wastewater. The experimental parameters used in the study include 3 levels of wastewater strength, 5 dosages of clay adsorbent, and 3 levels of live liquid microorganisms (LLMO) dosages. The clay dosages used include 0, 0.5, 1, 1.5, and 2 g/L. Runs 2, 3 and 4 were with LLMO addition, while run 1 was without LLMO addition. For run 1, the ranking highest for TOC removal to the lowest was 54.67%, 30.18%, and 59.67%, for potato wastewater, sugar wastewater, and combined potato and sugar wastewater, respectively. In general the low strength wastewater had higher TOC removal than the medium and high strength wastewater. LLMO addition was found to improve TOC removal. The highest TOC removal for potato wastewater was 60.37% for medium strength wastewater at the highest LLMO dosage and highest clay dosage. For combined potato and sugar wastewater the highest TOC removal was 66.33% for low strength wastewater at the highest LLMO dosage and highest clay dosage. The general trend indicated that as wastewater strength increased the TOC removal decreased. Both clay adsorbent and bioaugmentation with LLMO improved the TOC removal for food wastewater.

2:45 BIOREMEDIATION OF CONTAMINATED SOIL WITH BIOSLURRY REACTOR PROCESS. Howard H. Lo, Biological, Geological, and Environmental Sciences Dept, Yung-Tse Hung and Vidyarani Velagandula, Civil Engineering Dept, Cleveland State University, Cleveland OH 44115.

This paper describes the remediation of soils contaminated with petroleum hydrocarbons using bioslurry reactor process. Petroleum hydrocarbons are one of the most common soil pollutants in the U.S. Bioslurry reactor process is a relatively new treatment technology for destruction of soil contaminants. Pilot scale aerobic bioslurry reactor was used in this study. The soil samples were collected from around the leaking underground petroleum fuels storage tank. The solid concentration in the bioslurry reactor was 26.7%. Nitrogen and phosphorus nutrients were added to the reactor. The study was conducted without bioaugmentation. Process-gas-recirculation system was used with the reactor for complete containment and eventually complete degradation of all contaminants. Results indicated that the concentrations of benzene, toluene, ethyl benzene, and xylenes (BTEX) and of naphthalene, anthracene, and phenanthrene decreased rapidly. The percentage removal after 2 days varied from 82 to 98% in the soil phase. About 100% removal was observed in the liquid phase of reactor after 8 days of treatment. However, polyaromatic hydrocarbons (PAHs) containing more than 3 aromatic rings did not show significant removal. Addition of rapidly metabolizing substrates such as sodium acetate, and phenanthrene did not improve the degradation of PAHs containing more than 3 aromatic rings. The augmented phenanthrene was rapidly metabolized. In conclusion, bioslurry reactor can be used for remediation of soils contaminated with BTEX chemicals and PAH with 3 or less aromatic rings. The bioslurry reactors may not achieve the required removal of low level of PAH containing 4 or more aromatic rings from contaminated soils.

3:00 TREATMENT OF CADMIUM AND ZINC WASTEWATER BY ELECTRO-COAGULATION/FLOTATION BATCH REACTOR. Yung-Tse Hung and Mario G. Cora-Hernandez, Civil Engineering Dept, Cleveland State University, Cleveland OH 44115, Ruth Yu-Li Yeh, Chemical Engineering Dept, Ming-Hsin Institute of Technology, Hsinchu, Taiwan.

The paper presents studies conducted on a bench scale electrocoagulation/flotation batch reactor used in the treatment of wastewater containing cadmium and zinc metal ions. The objective of the study was to examine the ability of this reactor to treat wastewater containing variable concentrations of one single metal at a time, or the combination of both. A 5-liter Plexiglas batch reactor was built and provided with two stainless steel plates. The entire unit was connected by electric cables to a direct current power supply capable of providing up to 13 volts. Experiments were conducted at detention times of 5, 10, 15, and 30 minutes, and current values of 1, 3 and 6 amperes. Heavy metal concentrations ranged between 10 to 30 mg/l. The pH level in the solutions varied from 8 to 10.5 units, adjusted by the addition of lime ($Ca(OH)_2$). Sodium chloride (NaCl) was added to increase current transfer efficiency. Experimental results showed that the unit was capable of achieving 85 to 98% cadmium removal efficiency within 15 to 30 minutes of detention time. Zinc removal efficiency ranged between 99.80 to 99.83% under similar detention times. The reactor was capable of simultaneous removal of cadmium and zinc metal achieving values up to 99.96% and 99.10%, respectively. It also consistently achieved wastewater effluents with a cadmium and zinc concentration as low as 0.11 and 0.01 mg/l, respectively. These results comply with the current promulgated effluent pretreatment standard for industrial facilities. Ultimately, it was found that the anode served as a sacrificial electrode providing Fe(II) ions that formed iron complexes, which helped to enhance the coagulation process.

3:15 OIL WASTEWATER TREATMENT BY ULTRAFILTRATION PROCESS. Yung-Tse Hung, and Majid Zarrinafsar, Civil Engineering Dept, Howard H. Lo, Dept of Biological, Geological, and Environmental Sciences, Cleveland State University, Cleveland OH 44115, Ruth Yu-Li Yeh, Chemical Engineering Dept, Ming-Hsin Institute of Technology, Hsinchu, Taiwan.

This paper describes the investigation on the treatment of oily wastewater by ultrafiltration (UF) followed by membrane distillation (MD) as a final treatment process. A tubular UF module equipped with a polyvinylidene fluoride (PVDF) membrane and a capillary MD module with polypropylene membranes were used in the study. Bilge water was used in the treatment. The permeate obtained from the UF process usually contained less than 5 ppm of oil. Further treatment by membrane distillation removed 100% oil, 99.3% TOC (total organic carbon) and 99.9% TDS (total dissolved solids) with excellent treatment efficiency. The final effluent had very low electrical conductivity and very low value of 1.8 mg/L TOC. It is concluded that the combined ultrafiltration and membrane distillation process can be used in treating bilge water effectively.

3:30 COLOR REMOVAL FROM SECONDARY TREATED WASTEWATER EFFLUENT USING ULTRAFILTRATION. Yung-Tse Hung and Nagasekhar R. Gorla, Civil Engineering Dept, Cleveland State University, Cleveland OH 44115, Ruth Yu-Li Yeh, Chemical Engineering Dept, Ming-Hsin Institute of Technology, Hsinchu, Taiwan.

This paper describes the investigation of color removal from a wastewater treatment plant effluent with ultrafiltration (UF) combined with powdered activated carbon (PAC) addition to the aeration tank of an activated sludge plant. The treated effluent can be reused. The treatment system employed a rotating membrane UF module with a membrane UF module having a flux of 1 m^3/m^2-d. PAC was added at 50 mg/L to the aeration tank and the hydraulic detention time of aeration tank was maintained at 4.5 hours. The final effluent had a very low color level of less than 5 degree. The sludge had a mean diameter of 29.2 u m and was readily dewaterable. Ultrafiltration process combined with PAC addition to an aeration tank can be used to remove color from wastewater treatment plant effluent effectively.

3:45 ORGANIC POLLUTANT REMOVAL BY GRANULAR ACTIVATED CARBON ADSORPTION PROCESS. Yung-Tse Hung, and Madhu Latha Konduri, Civil Engineering Dept, Howard H. Lo, Dept of Biological, Geological, and Environmental Sciences, Cleveland State University, Cleveland OH 44115, Ruth Yu-Li Yeh, Chemical Engineering Dept, Ming-Hsin Institute of Technology, Hsinchu, Taiwan.

This paper describes the removal of organic pollutants from wastewaters by granular activated carbon (GAC) adsorption process. Different amounts of granular activated carbon were tested for the removal of aliphatic and aromatic pollutants present in wastewaters. A batch adsorption shaking test was conducted. It was observed that about 75% of organic pollutants were removed by GAC adsorption after a shaking time of 1 hour. The Freundlich constant K was found to range from 0.09 to 0.27, and the 1/n ranged from 0.19 to 0.58. The high K and $1/n$ values, calculated from the Freundlich equation, showed high adsorption capacity of GAC for the organic pollutants. The rate constant for adsorption using Lagergren's equation varied from 0.058 to 0.067 per min. Results indicated that the removal of aliphatic compounds had better removal efficiency than aromatic compounds, and aromatic compounds show a lower affinity for the GAC. Results showed that GAC could be used in treating wastewater containing aliphatic and aromatic compounds effectively.

4:00 LANDFILL LEACHATE TREATMENT USING GRANULAR ACTIVATED CARBON FLUIDIZED BED PROCESS. Yung-Tse Hung and Sudheer Gubba, Civil Engineering Dept, Howard H. Lo, Dept of Biological, Geological, and Environmental Sciences, Cleveland State University, Cleveland OH 44115.

This paper examines the treatment performance of a granular activated carbon (GAC) fluidized bed process in treating leachate from a sanitary landfill. The leachate contained a high COD (chemical oxygen demand) concentration of 500 to 2,700 mg/L, and a high NH_3 concentration of 220 to 800 mg/L. Prior to treatment by GAC fluidized bed process lime was added to the leachate to raise the pH to 9.0 to precipitate the heavy metals present in the leachate. Two GAC fluidized bed reactors were used in series to treat the limed softened leachate. The first reactor was used to remove BOD (biochemical oxygen demand), while the second reactor was used to remove ammonia by nitrification. At NH_3 loading rate of 1.56 kg NH_3-N/m^3-d, the reactors removed 70% NH_3, 60% COD and 100% BOD. The highest NH_3 removal of 90% was obtained at NH_3 loading rate of 0.7 kg NH_3-N/m^3-d. It was concluded that the GAC fluidized bed process could be used effectively in removing ammonia from landfill leachate with good BOD removal.

OFFICIAL ANNOUNCEMENT

Saturday, April 6, 2002, 1:15 PM.
Capital University, Columbus, Ohio
Learning Center, Room 202

ANNUAL BUSINESS MEETING
FOR MEMBERS ONLY:

There shall be an Annual Business Meeting for the membership of the Academy during the Annual Meeting. The business session shall be conducted in accordance with the most recently published edition of *"Robert's Rules of Order"*. The order of procedure shall be as follows:

A. A Call to Order by the President.
B. A summary of the Minutes of the previous meeting shall be read by the Secretary.
C. Presentation of the report of the tellers of the election of officers and other positions.
D. Voting on any proposed amendments to the *Constitution* or *By-Laws*.
E. Business from the floor.
F. Adjournment.

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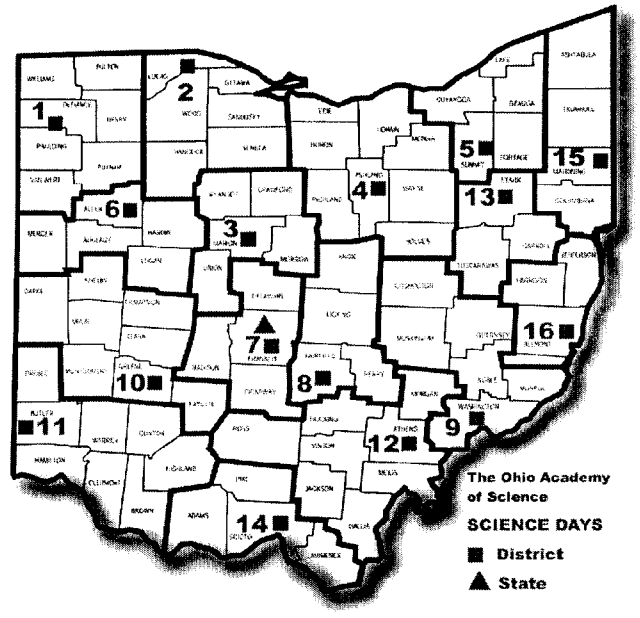

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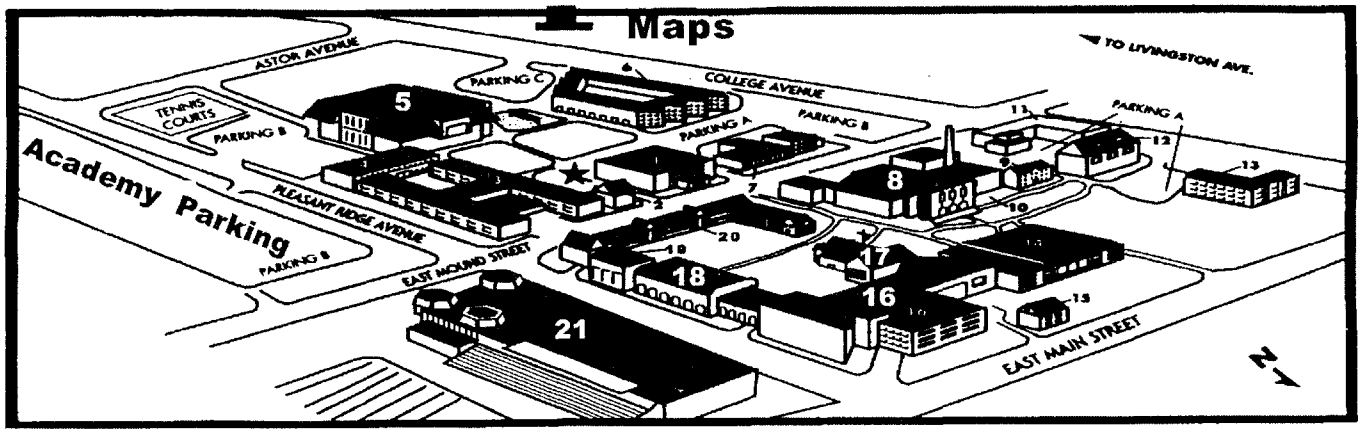

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REGISTRATION in Lobby of Huff Learning Center (16).
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From the west: Travel I-70 to the Bexley/Main street exit. The exit ramp automatically turns onto Alum Creek Drive, which will dead end at Main Street (in front of the Kroger store). Turn right (east) on Main Street. At the fourth traffic light, turn right (south) on Pleasant Ridge Avenue.

From the east: Travel I-70 to the Livingston Avenue exit. Turn left (west) on Livingston Avenue, then turn right (north) at the first traffic light onto Alum Creek Drive. When Alum Creek dead ends in front of the Kroger store, turn right (east) on Main Street. At the fourth traffic light, turn right (south) on Pleasant Ridge Avenue.

From the northwest: Travel south on I-75 to Route 23. Follow Route 23 into Columbus and take I-270 east to I-71. Travel south on I-71, exit on Broad Street. Turn east onto Broad Street and drive 2.5 miles to Drexel Avenue in Bexley. Turn right onto Drexel and continue south until Drexel ends in front of the campus at Main Street. Turn left (east) onto Main Street. At the next light, Pleasant Ridge Avenue, turn right (south).